HERBICIDE OPERATIONS MANUAL

Prepared by

Vegetation Management Staff
Maintenance Division (MNT)
(512) 416-3093

2011 Season

Texas Department of Transportation

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SECTION 1

1.0 INTRODUCTION TO HERBICIDES

Major reasons for highway right of way vegetation management practices include:

- To maintain the integrity of the paved surface;
- To prevent or reduce erosion;
- To provide for the safety of the traveling public;
- To provide for efficient maintenance practices;
- To maintain drainage;
- To provide beauty, and;
- To provide wildlife habitat.

Vegetation management along the transportation system consists of propagation and control of vegetation. Control of vegetative growth may be accomplished by a combination of physical and chemical methods. Physical methods of vegetation control include hand- pulling, hoeing, plowing, cultivating, trimming and mowing. Chemical methods include the application of approved herbicides to control specific vegetation problems. TxDOT's herbicide program is based upon extensive research for chemicals which will provide the desired control of the target species while presenting the minimum possibility of harm to the environment, the applicator, or to the traveling public. The use of herbicides is a key element to be used in combination with physical vegetation control methods to manage right of way vegetation.

There are numerous chemicals being registered by the Environmental Protection Agency (EPA) for both agricultural (crop) and right of way (non-crop) situations. Some of these chemicals have proven to provide excellent benefits to the vegetation manager in over-coming and/or controlling specific vegetation problems along the transportation system.

SECTION 2

2.0 VARIABLES AFFECTING HERBICIDES

Herbicide activity may be affected by many factors including:

- Species of Plant being Treated;
- Soil Type;
- Wind;
- Humidity;
- Rainfall;
- Temperature;
- Water Quality;
- Mixing and Application Procedures and Timing;
- Maintenance Supervisor; and
- ***Individual Herbicide Applicator.***

2.1 Type and Species of Plant to be Controlled

Proper selection of herbicides and proper application rates are dependent upon the type and species of vegetation to be controlled, as well as the condition of the plant species itself. Some plant species are more resistant to certain herbicides than are other more sensitive plants. The plant may be in either an active growth or a dormant growth stage. The plant may be a seedling or may be a mature plant. The plant may be in the process of budding, leafing, flowering or fruiting. Each of these conditions has a bearing upon how herbicides work and should be considered when you decide where and when to use herbicides.

For example, the best time to apply a foliar herbicide for the control of Johnsongrass is when the species is in the early seedhead or fruit production ("boot") stage. This applies to most other pest species as well. In general, seedling plants (immature plants just emerging), are much easier to control than established plants.

Plants are categorized as an annual, biennial or a perennial.

2.1.1 Annual and Biennial Plants

Both annuals and biennials originate from seed (not from permanent rootstock). Annuals complete their entire life cycle in one growing season or year (seed to seed); biennial plants require two years to complete their life cycle.

2.1.2 Perennial Plants

Perennial plants have extensive root systems and live for many years. Perennials produce seed as well to ensure survival of the species. Generally higher rates of herbicides will control perennial plant species.

2.1.3 Aquatic Plants

Aquatic plants, which may be annual, biennial or perennial, are associated with water or wetland areas, and typically have large, glossy, waxy leaves or sometimes with a hairy surface. For aquatic plant control, TxDOT utilizes only an ***Approved Aquatic Herbicide***. These herbicides have been approved by the EPA for the broad-spectrum control of vegetation within or adjacent to aquatic sites. An aquatically approved surfactant must be added to the ***Approved Aquatic Herbicide***. ***Aquatic Herbicides*** used by TxDOT herbicide applicators to be considered approved by the Vegetation Management Section Staff will contain 54% Glyphosate and 46% Water (**i.e. Rodeo® and Aquamaster®)**. All products used by TxDOT herbicide applicators have been extensively tested and researched by the Vegetation Management Section Staff before being released for use.

2.2 Soil Type

Proper application rates as recommended within this document normally produce excellent results. Soil type, however, has an effect upon how well all herbicides work. Soil-active (residual) herbicides are more effective in soils, which are low in clay or organic matter. In high clay soils, herbicide molecules attach (adsorb) to the clay particles and are not available for plant uptake. In heavy clay soils, therefore, the application rates may need to be increased.

The acidity or alkalinity of the soils also have an affect upon the performance of herbicides. For example, in relatively acidic soils, often found within parts of East Texas, **Landmark® XP** and **Outrider®** decomposes at a faster rate (thus providing a shorter residual period), than it does in the more alkaline soils commonly associated with central and West Texas.

2.3 Wind Velocity

Wind will always disturb the spray pattern and blow chemical away from the target area. High winds can blow it several feet away from the target. The wider the pattern, the greater the effects of wind distortion. The best time to spray is before wind velocity rises (i.e. early in the morning). The addition of the proper drift control will help reduce drift. Drift control WM is relatively inexpensive and in many instances can reduce spray drift sufficiently for spraying to continue. However, if wind velocities rise to the point that the pattern cannot be kept on target, spraying should be discontinued.

For purposes of deciding whether to spray and for record keeping, always carry a wind gauge in the spray unit.

Winds over 5 mph may cause drift. Spraying operations should cease when winds are of such intensity that you cannot keep your spray on the target.

2.4 Humidity

Relative humidity is defined as the percent of moisture in the surrounding air relative to the maximum amount, which the atmosphere could hold. Generally, the higher the relative humidity at the time of application, the more rapid plants will absorb foliar-applied herbicides. However, when relative humidity approaches 100 percent, rainfall will likely occur and the chance that the herbicide will be washed from the foliage increases. Consequently, herbicides should not be applied when rainfall is threatening or is imminent.

2.5 Rainfall

Rainfall affects chemical control of vegetation in many ways. Rainfall acts as the vehicle, which carries soil-active (residual) herbicides into the root zone of plants. Residual chemicals, in order to enter the root system of the target species, must be in solution. Excessive soil moisture may move (leach) the residual herbicide below the root zone and result in poor control. Moisture from rainfall, thawing cycles, and snow may prevent the herbicide from entering the soil in concentrations necessary to achieve the desired degree of control. Moreover, excessive rainfall may lead to serious herbicide damage to vegetation outside of the target area.

Do not spray herbicides during rainfall or when rainfall is predicted within 1–2 hours after application. Rain will wash herbicide off the foliage of target species before it can be absorbed by the plant. Conversely, after a rain, dust on the foliage will have been washed off and foliar-applied herbicides can be easily absorbed by the plant. Allow the foliage time to dry after a rain before conducting spraying operations as wet foliage may also yield poor results.

2.6 Temperature

Temperature affects the action of herbicides and the degree of control achieved as well. Do not apply herbicides when the soil is frozen, when rain or snow is falling, or when there is snow on the ground. High temperatures, typical during the hot-dry summer months, cause many plant species to become dormant. When these conditions occur, plants will not absorb the herbicide and control will be reduced.

2.7 Water Quality

Water is an important factor affecting the action of all herbicides, especially when applying the herbicide Roundup PROMAX®. Always use the cleanest water available to mix herbicides, as impurities and soil particles in the water will bind or "tie up" the herbicide molecules and deactivate the chemical. Additionally, Landmark® XP and Outrider® herbicides, decompose faster in acidic water. For those instances where acidic water must be used, mix smaller batches to prevent Roundup PROMAX® and Outrider® from becoming ineffective.

Impurities in the water, such as sand or clay particles, may also clog filters and damage centrifugal pumps, electric solenoids and nozzles.

2.8 Application Methods and Timing

Proper application methods and timing of your spray operations are essential to the success of any spraying program. Residual herbicides must be applied uniformly. Foliar-applied herbicides must be applied uniformly to the surface of the foliage of the target species.

Both residual and foliar-applied herbicides require proper timing for proper control and effective performance of the chemical.

SECTION 3

3.0 TYPES OF HERBICIDES

3.1 Soil-Active (RESIDUAL) Herbicides

Residual herbicides remain active within the soil for a period of time and prevent germination of seeds and growth of roots. Residual herbicides are moved into the root zone by water and rainfall. The herbicide is absorbed by the plant's root system and distributed (translocated) throughout the plant. Plant growth processes are then affected. Toxic symptoms should begin to appear within several days.

The swiftness of how soon toxic symptoms begin to exhibit within the plant varies with the type of soil, rainfall rates, plant species, and the rate of herbicide actually applied. Residual herbicides can be applied to the soil in the winter months prior to or shortly after the initial emergence of new growth in the early spring.

Residual herbicides should **NEVER BE APPLIED TO BARE GROUND**. Vegetation should always be present before applying residual herbicides.

3.2 Foliar-Applied Herbicides

Foliar-applied herbicides, as the name implies, must be applied to the green and growing foliage of the target species to be effective.

The herbicide is absorbed through the foliage and transported (translocated) throughout the plant and stored in the root system. Several days are typically required before the toxic affects of the herbicide appear. Repeat application of foliar-applied herbicides may be necessary, as most foliar-applied herbicides used by TxDOT do not have any soil residual activity.

Additionally, certain plant species may be resistant to the herbicide, requiring either additional applications or the use of more than one chemical in combination if broad-spectrum control is required.

SECTION 4

4.0 TYPES OF CONTROL

4.1 Bare Ground (COMPLETE) Vegetation Control

Bare ground situations may be appropriate where there is a specific reason for such a treatment. Treating the edge of pavement or vegetation encroachment within paved shoulders are good examples where bare-ground herbicide rates may be appropriate.

Continuous bare ground treatment especially on sloped areas increase the potential for erosion and sediment loss. For those areas, which receive bare-ground herbicide applications, additional spot-treatments may be necessary.

Applications to the edge of pavement will not be any wider than 6 inches from the edge of the paved surface and 12 inches behind the guardrail. Applications wider than 12 inches may result in erosion and soil sediment loss.

Application of an excessive quantity of herbicide is not economical and may result in damage to nearby desirable vegetation.

Complete control may be achieved by using a mixture of ***Roundup PROMAX®*** at 3 quarts per acre plus ***Landmark® XP*** at 2-3 ounces per acre rate. Bare ground is **not recommended under guardrails, or around signage, delineator posts, mailbox supports, etc.**

4.2 Selective Weeding

Selective weeding is the use of an herbicide or combinations of herbicides for the control of target plant species, but which does not permanently harm desirable vegetation. Herbicides, which are used for this type of control, may be selective or low rates of non-selective herbicides. Examples would be ***Roundup PROMAX®*** plus ***Outrider®*** at 8 ounces plus 1.33 ounces per acre for the control or Johnsongrass, ***Escort® XP*** at a 1 ounce per acre rate for the control of Field Bindweed and Common Sunflower, ***Transline®*** at 10 ounces per acre rate for the control of weeds such as Musk Thistle and ***Vista® XRT*** at 6 ounces per acre plus surfactant at the rate of 2 quarts per 100 gallons of water for Giant Ragweed control.

4.3 Chemical Mowing

Chemical mowing is the practice of using ***Roundup PROMAX®*** to control undesirable vegetation which is in close proximity to desirable plant material. This procedure may be utilized to control vegetation along fence lines, under guardrails, and within landscaped areas.

Chemical mowing is most often performed by using *Roundup PROMAX®* at the proper rate for the type of control desired.

SECTION 5

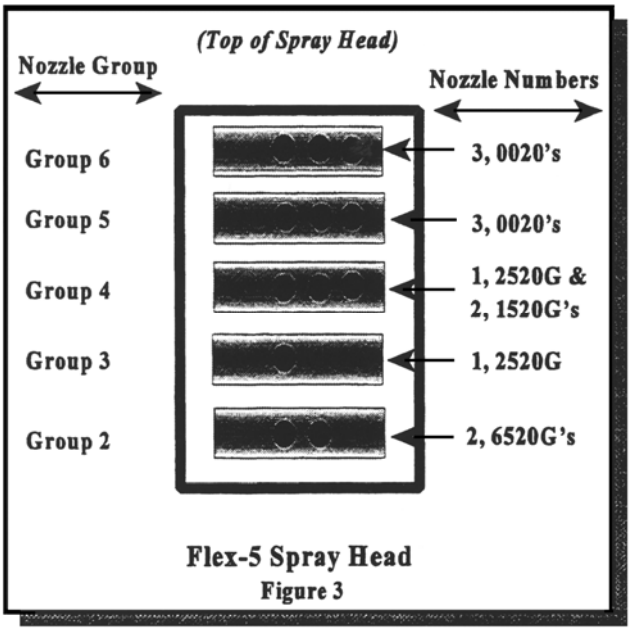
5.0 EQUIPMENT

5.1 Model 85 Spray Unit (GSD Issue)

The Model 85, which was initially produced within the General Services Division shops in 1985, is the spray unit, which is predominantly in current use.

The Model 85 Spray Unit uses an electrically activated spray head called a Flex-Five spray head to spray wide areas of the right of way.

As shown in **Figure 3**, the Flex-Five spray head consists of five, independently operated nozzle groups.

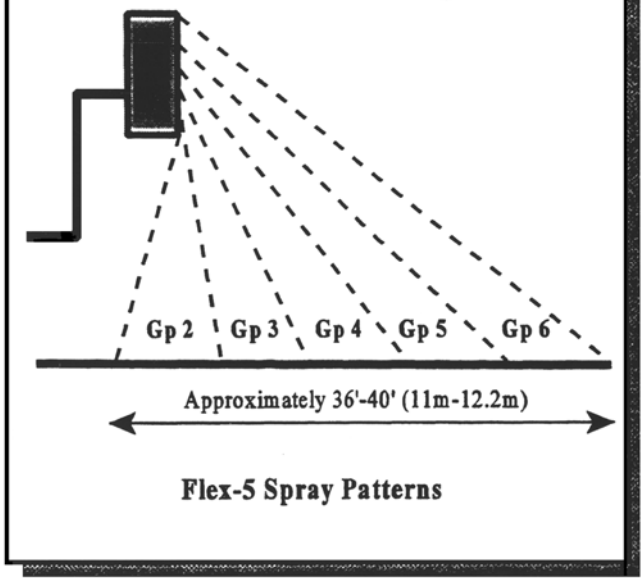


Flex-5 Spray Head
Figure 3

Nozzle Group 2 includes two 6520G nozzles. Nozzle Group 3 has one 2520G nozzle. Nozzle Group 4 includes one 2520G nozzle and two 1520G nozzles. Nozzle Groups 5 and 6 both include three 0020 nozzles.

The spray pattern adjusts vertically by an electric cylinder operated from the control panel in the vehicle. This adjustment permits the applicator to maintain a constant spray width even on sloping terrain. Although wind affects all spray patterns, the flex-five spray head is designed to be able to spray wide areas (approximately 36-40 feet), as seen in **Figure 4.**

Figure 4

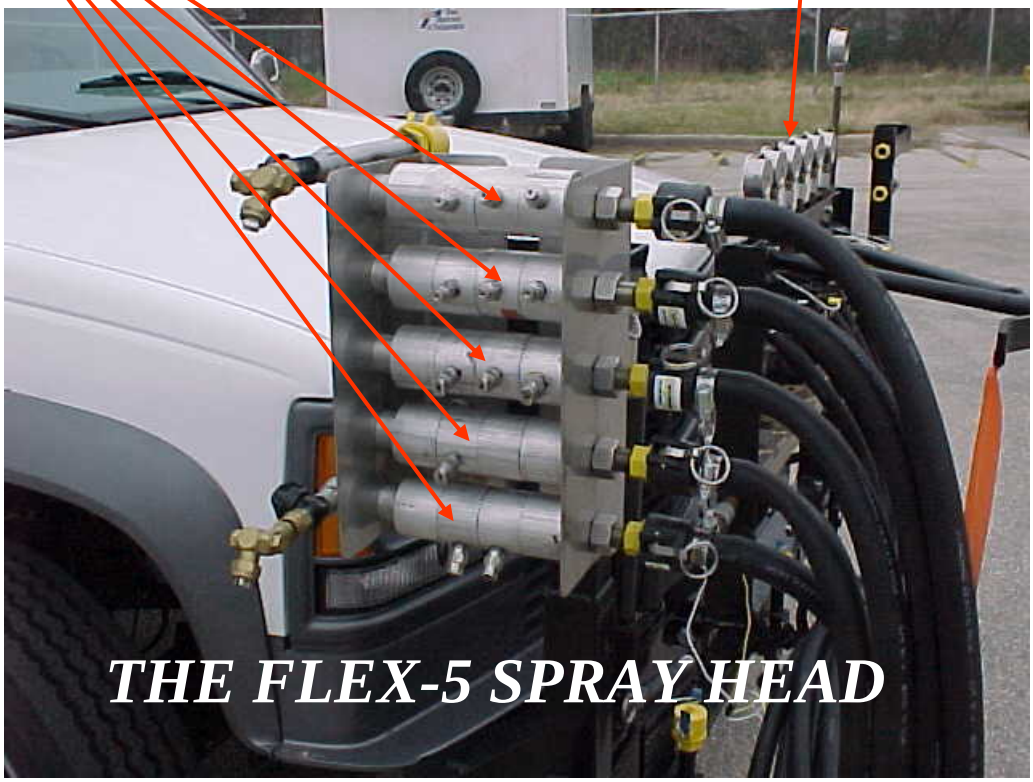


Flex-5 Spray Patterns

Example of nozzle sizes: Nozzle number 6520 directs the spray pattern at a 65 degree angle and distributes 2 gallons of solution per minute

5 Nozzle Banks

Spray Pressure is 30 psi



THE FLEX-5 SPRAY HEAD

Pre-Calibrated to 25 Gallons per Acre

Spray Speed is 11.4 Miles per Hour

As seen in **Figure 5**, this unit is distinguished by a spray head system, which includes a 50-mesh in-line filter, followed by the main pressure gauge and a series of six, in-line electric solenoids. On the downstream side of each of the electric solenoids, are flow regulators and pressure gauges.

At the downstream side of the last, in-line electric solenoid, is the by-pass pressure regulator, which permits return of excess fluid to the main tank during spraying operations.

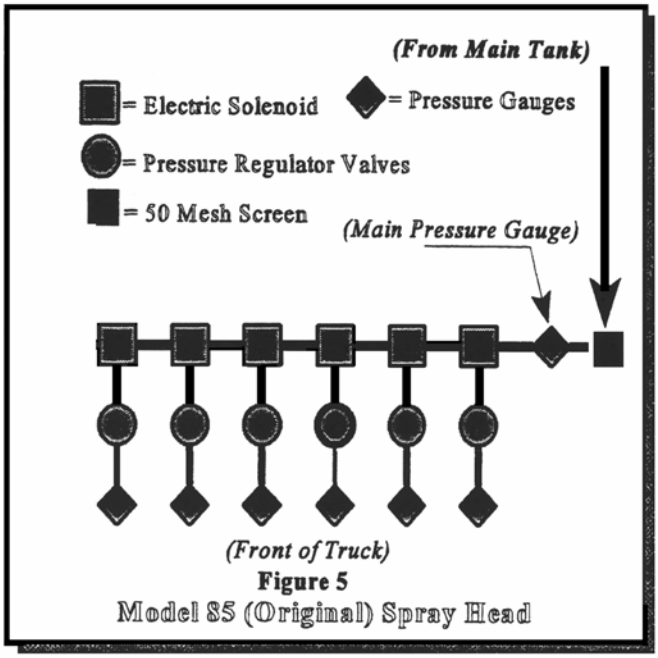
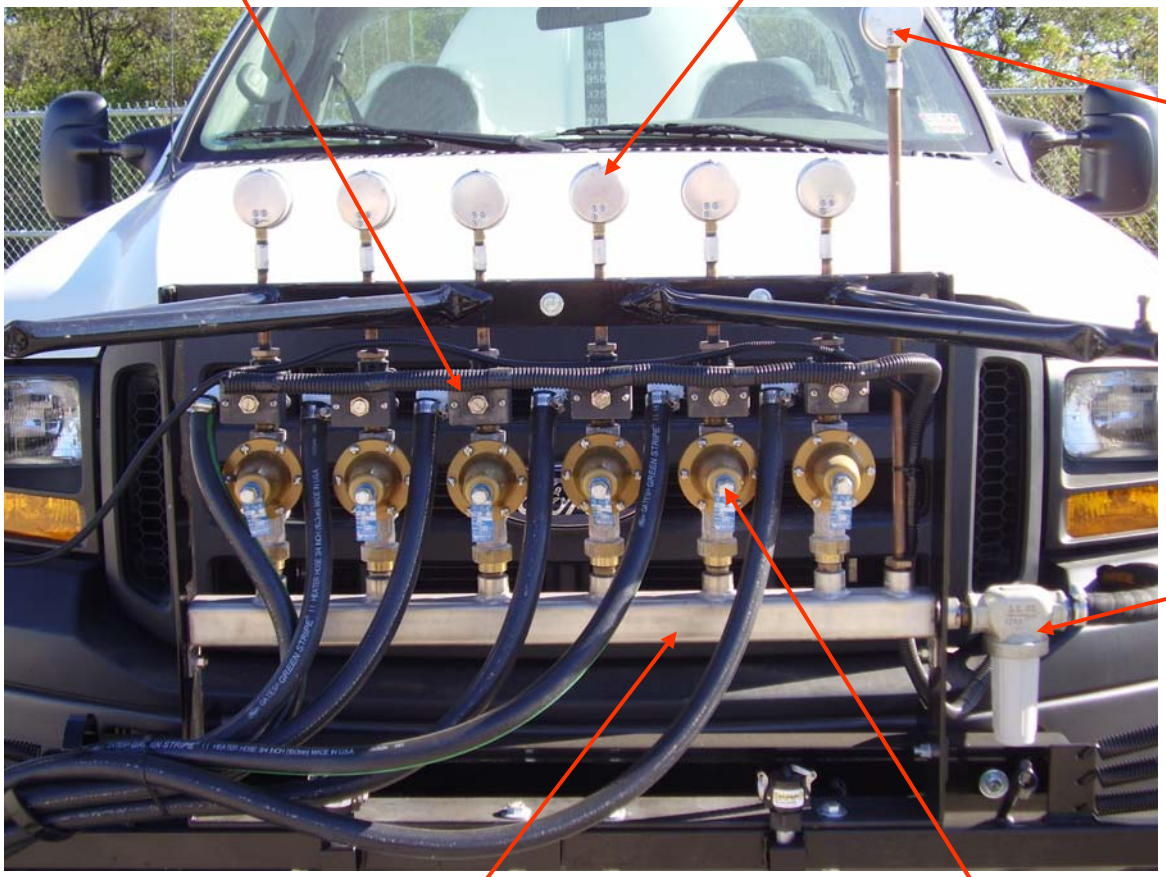


Figure 5
Model 85 (Original) Spray Head

As illustrated on the next page, the main difference between the newer Model ’85 unit and the older unit is that the solenoids and flow regulators have been “switched” around. This helps with the repair and replacement of solenoids, which need to be checked on a regular basis. Also on the newer Model ’85 unit the return hose to the tank and pressure relief valve have been eliminated.

Model 85 (Modified) Spray Head-Figure 6



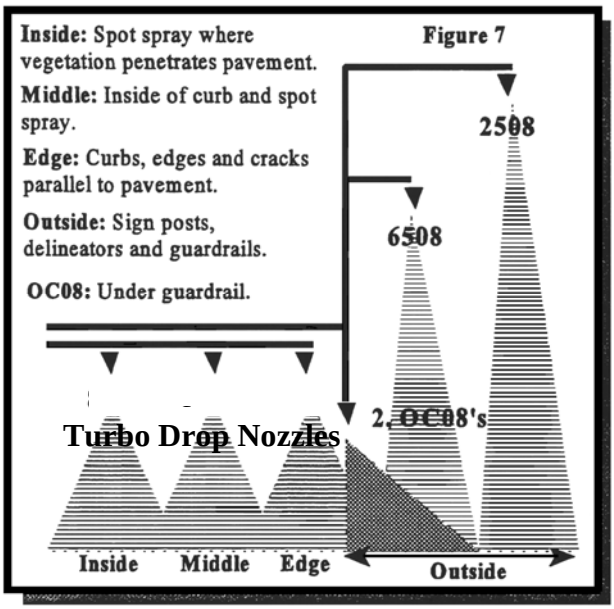
5.1.1 Fixture Operations

The fixture operation does not utilize an electrically or hydraulically operated boom system, but includes an arrangement of nozzles for spraying outside of the guardrails, under guardrails, inside, middle and edge of pavement on right or left hand sides of the vehicle. These units were fabricated within the General Services Division shops.

As seen in **Figure 7,** the fixture spray operation is capable of spraying with the Inside, Middle, Edge and Outside nozzle depending on need. Use an TurboDrop nozzle for both the Inside and Middle, a TurboDrop nozzle for edge work, two-OC08's for guardrail work, and a 6508 and 2508 for outside spraying around shoulders, guardrails, delineators, signs, etc.

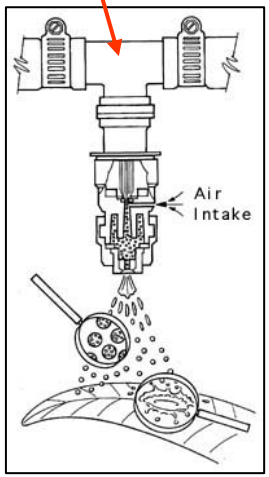
The fixture nozzles are not used to spray wide areas of the right of way.

Spray pressures should be set on 35 psi to insure proper operation of the diaphragm check valves. See Figure 8.

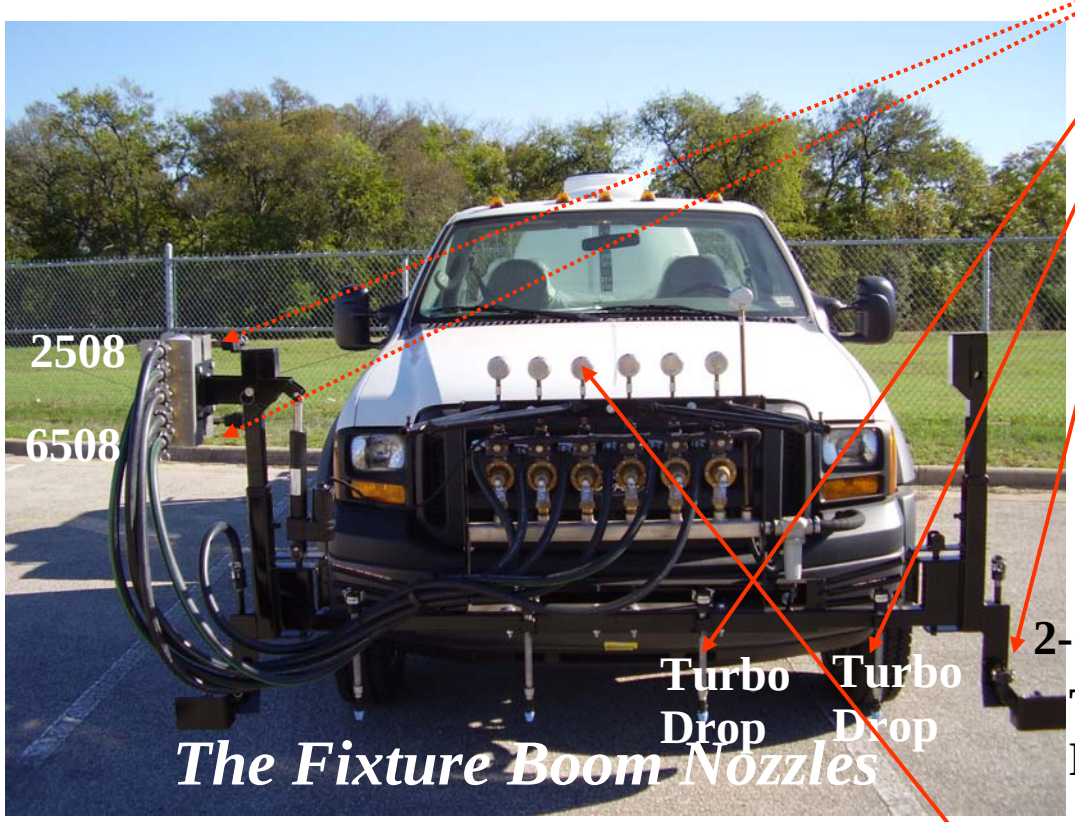


Fixture Boom Nozzles-Figure 8

(Turbo-Drop Speed is 10 mph)



6 Nozzles on Each Side



Must be Calibrated

ANNUALLY

2-OC08'S

Turbo Drop Edge

Spray Speed is

5 mph

Spray Pressure is

35 psi Standard

30 psi TurboDrop

5.2 Turbodrop Nozzles

Turbodrop nozzles are an optional nozzle type that replace the edge 6508 and the two 8008's below and are used for the edge of pavement, inside and middle nozzle positions. These nozzles installed will change your driving speed from 5 MPH to 10 MPH, therefore cutting application time in half. Calibration for these nozzles are the same except speed should be calculated at 10 MPH instead of 5 MPH. These nozzles have DHT numbers and can be ordered through the TxDOT warehouses. Please call the Vegetation Management Section Staff for details concerning these nozzles.

5.3 Wick Applicator

DO NOT wipe desirable vegetation.

Rope-wicks are generally used for thin stands of undesirable vegetation. When an undesirable stand of vegetation exceeds 35 percent of the ground surface, use the overspray operations of the herbicide spray unit. Before using the rope-wick check to make sure all of the ropes are wetting. Check possible sources of obstructions in the lines from tank to rope. The ropes used on the rope-wick should be polyester over acrylic ropes.

The herbicide mixture rate is two parts water to one part ***Roundup PROMAX®***. In tougher to control weed species areas a mixture rate of one part water to one part ***Roundup PROMAX®*** may be used.

SECTION 6

6.0 SURFACTANTS

6.1 General Characteristics of Surfactants

Surfactants are surface-active agents. They are useful as wetting or spreading agents. They act by increasing the contact between the liquid (i.e. herbicide/surfactant mixture) and the leaf surface of the pest plant, usually by reducing the surface tension of the spray droplets. Therefore, surfactants enhance the activity of the herbicide. An example of this can be seen when a drop of water is applied to a waxy leaf; it beads up. However, if detergent is added to the water first, then the droplets will spread out more readily. In this case the detergent is a surface-active agent, or a surfactant.

6.2 Mixing Rates for Department Stocked Surfactants

In Approved Aquatic Herbicide applications, always add 2 quarts of surfactant per 100 gallons of water. For ***Escort® XP*** applications, always add 1 quart surfactant per 100 gallons of water. When using ***Outrider®*** or ***Vista® XRT*** by itself always add 2 quarts of surfactant per 100 gallons of water. For ***Transline®*** applications on brush mix 2 quarts of surfactant per 100 gallons of water.

A surfactant must be added to ***Approved Aquatic Herbicide*** and ***Escort® XP*** applications. If a surfactant is not used results will be significantly reduced.

6.3 Surfactants Approved for Use with Department-approved Herbicides

All surfactants received from the regional warehouses meet the approval of the Vegetation Management Staff in the Maintenance Division. These surfactants are safe for use with ***Approved Aquatic Herbicide*** applications sprayed directly in water and also for use with ***Escort® XP, Transline®, Vista® XRT*** and ***Outrider®,*** when applied alone.

6.4 Precautions Using Surfactants

Always read label directions prior to using any product, whether surfactant or herbicide.

When using surfactants with there are some very important safety considerations:

Always wear goggles and gloves when mixing surfactants. They may cause eye or skin irritation. Wash thoroughly after handling surfactants.

Many surfactants are flammable and may burn with explosive violence. The liquid quickly evaporates and forms a vapor, which can catch fire. Keeps away from heat, open flames, sparks and hot surfaces. Invisible vapor spreads easily and can be set on fire by such sources as pilot lights, welding equipment, electric motors and switches. The fire hazard is greater as the liquid temperature rises. Use only in well ventilated areas. Keep container closed when not in use. Clean up spills immediately.

Do not weld, heat or drill the container. Dispose of empty containers immediately according to label directions.

SECTION 7

7.0 DRIFT CONTROL AGENTS

7.1 Information About Drift Control Agents

Drift control agents reduce drift; they do not eliminate drift. Winds above 5 mph may cause drift. Drift control agents reduce the fine particles created by the nozzle tip. Drift may still occur if the spray pressure is too high or the wind velocity is too great. All spraying should cease when patterns cannot be kept on target.

Control WM rate will be 2 ounces per 100 gallons of water.

7.2 Approved Drift Control Agents

Control WM received from the regional warehouses meets the approval of the Vegetation Management Staff in the Maintenance Division for all herbicides listed.

7.3 Mixing Control WM With Roundup PROMAX® and Landmark® XP

Fill tank ¾ full of the required amount of water. Add the required amounts of ***Landmark® XP*** while maintaining agitation. With the agitators on add the remaining ¼ amount of water. Add the recommended amount of ***Roundup PROMAX®.*** Shake Control WM vigorously and inject the proper amount of drift control through the drift control injector with the agitators on and the bypass valve open. Inject the drift control very slowly to ensure adequate mixing. Leave the agitators on while operating the herbicide unit.

7.4 Mixing Control WM With Roundup PROMAX®, Escort® XP and Outrider®

Fill tank ½ full of the required amount of water. Add the required amounts of ***Outrider®*** and ***Escort® XP*** while maintaining agitation. With the agitators on add the remaining ½ amount of water. Add the recommended amount of ***Roundup PROMAX®***. Inject the proper amount of Control WM through the drift control injector with the agitators on and the bypass valve open. Inject the drift control very slowly to ensure adequate mixing. Leave the agitators on while operating the herbicide unit.

7.5 Mixing Control WM With Roundup PROMAX® and Outrider®

Fill tank ¾ full of the required amount of water. Add the required amount of ***Outrider®*** while maintaining agitation. With agitators on fill the remaining ¼ amount of water and the recommended amount of ***Roundup PROMAX®***. Shake Control WM vigorously and inject the proper amount of drift control slowly through the drift control injector with agitators on and bypass valve open. Leave the agitators on while operating the unit.

7.6 Mixing Control WM With Approved Aquatic Herbicide

Fill tank with the required amount of water. Shake Control WM vigorously with the agitators on and the bypass valve open; inject the proper amount of drift control through the drift control injector. Inject the drift control very slowly to insure adequate mixing. Add the recommended rate of ***Approved Aquatic Herbicide***. Leave the agitators on while operating the herbicide unit.

7.7 Mixing Control WM with Escort® XP and Milestone® VM Plus

Fill tank ½ full of the required amount of water. Add the required amount of ***Escort® XP*** or ***Milestone® VM Plus***. Fill the remaining ½ of batch. Shake Control WM vigorously and with the agitators on and the bypass valve open; inject the proper amount of drift control agent through the drift control injector. Inject the drift control very slowly to provide adequate mixing. Leave agitators on while operating the herbicide unit.

7.8 Mixing Control WM with Transline®

Fill tank with the required amount of water and add the appropriate amount of ***Transline®***. Shake Control WM vigorously with the agitators on and the bypass valve open; add the required amount of drift control through the drift control injector. Inject the drift control slowly to provide adequate mixing. Leave agitators on while operating the herbicide unit.

7.9 Mixing Control WM with Vista® XRT

Fill tank ¾ full of the required amount of water. Add the appropriate amount of ***Vista® XRT***. Fill the remaining ¼ of batch. Shake Control WM vigorously and with the agitators on and the bypass valve open; inject the proper amount of drift control agent through the drift control injector. Inject the drift control very slowly to provide adequate mixing. Leave agitators on while operating the herbicide unit.

DO NOT pour drift control in the top of the tank. The drift control will not mix properly and will clog the herbicide system.

DO NOT SPRAY HERBICIDES WHEN WINDS ARE TOO STRONG AND SPRAY PATTERN CANNOT BE KEPT ON TARGET!

SECTION 8

8.0 CALIBRATION

8.1 Reasons for Calibration

Poor results obtained after an herbicide application may be a result of careless application methods. It is extremely important to calibrate the herbicide spray unit for the different spray operations. The pre-calibration phase involves the inspection of all parts of the spray system for proper operation and cleanliness.

To calibrate the herbicide spray unit use the following formulas to calculate the gallons per acre (GPA):

For additional examples of calibration procedures, see Section 15 pages 73-80.

$$GPA = \frac{5940 \times \text{Gallons Per Minute (GPM)}}{\text{Miles Per Hour} \times \text{Spray Width (inches)}}$$

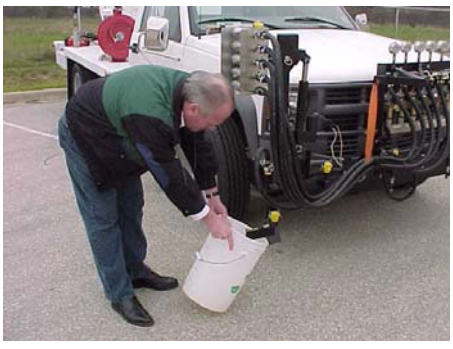
Note: 5940 is a constant

To determine the amount of chemical to add to the herbicide tank. Find the number of acres a given batch will spray.

$$Acres = \frac{\text{Batch Size (gallons)}}{GPA}$$

To find the amount of herbicide to add to the tank, multiply the number of acres by the rate of herbicide.

Amount of Herbicide = Acres x Rate of Herbicide



8.2 Calibration during Fixture Boom Operations

The nozzles used for fixture applications are located at different heights and spray different width patterns. This results in a variation in **GPA** from each nozzle. For this reason, an average GPA is sufficient for the required records and mixing procedures.

To determine the **GPA**, the following procedure should be used:

- Check operating fluids on both truck engine and independent engine.
- Inspect and clean filter screens.
- Add 100 gallons of water to the main tank.
- Open the main valve (from the bottom of the main tank) and bypass valve (located above the manifold on the outflow side of the pump). Also, open the tee-jet agitators located on the manifold.
- Turn independent engine switch on in the cab and after warm up increase throttle from inside of the cab.
- Add 2 ounces of drift control to the drift control injector and open ball valve to inject the drift control **VERY SLOWLY.** Do not allow air from drift control injector to enter the spray system**.** However, if air does enter and the pump loses prime, open bleeder valve at top of pump to bleed off air.
- To set spray pressure for fixture nozzles, increase the RPM of the independent engine to have 40-50 psi (or enough pressure to run the system properly) on the main pressure gauge with all nozzles spraying. Then loosen lock nuts on the pressure regulators and adjust the stem to achieve 35 psi on all spray pressure gauges. Once spray pressure is set at 35 psi, turn solenoids on and off several times to check spray pressure setting. Then tighten lock nuts on the pressure regulators. Be sure diaphragm check valves are working when solenoids are turned on and off. The diaphragm check valves are located just above the spray nozzle and stops the nozzle from dripping. The caps on the diaphragm check valves should only be tightened enough to prevent leakage. If they are too tight the valve will not open (you will read spray pressure even if the check valve does not open.
- To calibrate the GPA on the fixture nozzles, catch the fluid from the edge nozzle (6508) and the two upper nozzles (6508 and 2508), for one minute each. Measure the fluid to achieve GPM. Then adjust patterns of these three nozzles to achieve a good pattern with no gaps between the spray patterns. Spray these nozzles together at 5 mph to check the pattern and then measure the width of the spray pattern in inches. (In windy conditions, spray with the wind and measure and then spray against the wind and measure. Average the two spray widths and use this measurement in the calibration formula.)

After measuring GPM and spray width in inches, you are ready to calculate GPA using the following formula:

$$GPA = \frac{5940 \times GPM}{5\text{-mph} \times \text{Spray Width (inches)}}$$

Once GPA is calculated, the amount of herbicide can be determined by dividing GPA into total gallons of mix desired which equals total number of acres to be sprayed. Then the

number of acres multiplied by the rate of herbicide per acre equals the amount of herbicide to be added to the tank.

Mixing is accomplished by adding the appropriate amount of water to the tank. Then add the liquid herbicide to the 15 gallon chemical tank, if equipped (quantity based on calculations in step 9). Dry flowable herbicides need to be added to the top of the large spray tank. With the by-pass valve and the agitator valve open, slowly open the ball valve at the bottom of the 15 gallon tank to allow the herbicide to be pulled into the system and be mixed.

Once the herbicide tank is empty, close the valve to prevent air from being introduced into the pump. After the mixing is complete, close the by-pass valve to have spray pressure at the front of the spray unit.

8.2.1 Examples of Calibrating Fixture with Regular Nozzles

Drift control needs to be added in the proper sequence. Refer to Section 7.

Catch the fluid from all three nozzles for one minute:

Edge nozzle (6508)	87 ounces
Guardrail nozzle (6508)	112 ounces
Top nozzle (2508)	93 ounces
	292 ounces/minute

Divide 292 ounces per minute by 128 ounces per gallon to achieve 2.28 GPM

Measure the spray width of all the nozzles. 90 inches

The speed for fixture operations is 5 mph

Use the calibration formula.

$$GPA = \frac{5940 \times 2.28\ GPM}{5\ mph \times 90\ inches}$$

$$GPA = \frac{13543.2}{450}$$

GPA = 30.1 or 30

Once the GPA has been calculated, herbicide mixture can be made. The number of acres must be determined per batch size. Then the amount of herbicide can be calculated per batch size, depending on the type of treatment and rate of herbicide.

Example of Calibrating for SELECTIVE Vegetation Control:

GPA = 30

Rate of Roundup PROMAX® + Outrider® = 8 oz + 1.33 oz per acre

Batch size = 450 gallons of water

Acres = 450 gallons ÷ 30 GPA

Acres = 15

15 acre x 8 oz + 1.33 oz per acre = 3.75 quarts + 20 oz

To mix, the applicator adds 3.75 quarts of ***Roundup PROMAX®*** + 20 oz of ***Outrider®*** to 450 gallons of water in the tank.

Example of Calibrating for COMPLETE Vegetation Control:

GPA = 30

Rate of Roundup PROMAX® = 3 quarts per acre plus Landmark® XP = 3 ounces per acre

Batch size = 450 gallons of water

450 gallons of water ÷ 30 GPA

Acres = 15

15 acres x 3 quarts per acre = 45 quarts plus 15 acres x 3 ounces per acre = 45 ounces

To mix, the applicator adds 45 quarts (11.25 gallons) of *Roundup PROMAX®* plus 45 ounces of *Landmark® XP* to 450 gallons of water in the tank.

8.2.2 Examples of Calibrating Fixture with Turbodrop Nozzles

Catch the fluid from edge nozzle for one minute:

Drift control needs to be added in the proper sequence. Refer to Section 7.

Edge nozzle (Turbodrop) $\frac{128 \text{ ounces}}{128 \text{ ounces/minute}}$

Divide 128 ounces per minute by 128 ounces per gallon to achieve 1 GPM

Measure the spray width of all the nozzles. 24 inches

The speed for fixture operations with Turbodrop nozzles is 10 mph

Use the calibration formula.

$$GPA = \frac{5940 \times 1\ GPM}{10\ mph \times 24\ inches}$$

$$GPA = \frac{5940}{240}$$

GPA = 24.75 or 25

Once the GPA has been calculated, herbicide mixture can be made. The number of acres must be determined per batch size. Then the amount of herbicide can be calculated per batch size, depending on the type of treatment and rate of herbicide.

Example of Calibrating for COMPLETE Vegetation Control:

GPA = 25

Rate of Roundup PROMAX® = 3 quarts per acre plus Landmark® XP = 3 ounces per acre

Batch size = 500 gallons of water

500 gallons of water ÷ 25 GPA

Acres = 20

20 acres x 3 quarts per acre = 60 quarts plus
20 acres x 3 ounces per acre = 60 ounces

To mix, the applicator adds 60 quarts (15 gallons) of *Roundup PROMAX*® plus 60 ounces of *Landmark® XP* to 500 gallons of water in

8.3 Calibrating the Trailer Unit

8.3.1 Examples of Calibrating the Trailer Unit

Calibrating the Trailer Unit is very similar to calibrating the Herbicide Truck, but since this unit runs on the ROW it is operated at a slower speed usually 3 – 5 MPH.

The Trailer Unit consists of a single or tandem axle trailer with a 500 gallon low profile elliptical tank equipped with Tee Jet agitation, gasoline or diesel motor with centrifugal pump, Boom Buster or Boominator broadcast nozzles that spray up to 32 ft., Raven tractor mounted sprayer control with pressure regulator, electric ball valves, filters, hoses and valves.

Example: Boombuster nozzles running at 40 psi and 4 GPM. Ground application speed of tractor is 4 mph. Spray width 32 feet.

Note: 5940 is a constant

$$GPA = \frac{5940 \times \text{Gallons Per Minute (GPM)}}{\text{Miles Per Hour} \times \text{Spray Width (inches)}}$$

1st Catch the fluid from each nozzle for one minute and record in GPM:

Drift control needs to be added in the proper sequence. Refer to Section 7.

2nd Measure the spray width of all the nozzles and record in inches:

$$GPA = \frac{5940 \times 4 \text{ GPM}}{3 \text{ to } 5 \text{ mph} \times 384 \text{ inches}}$$

3rd Determine the application speed and record in miles per hour (Recommend 3 to 5 mph for most terrain):

4th Then, do the math:

$$GPA = \frac{5940 \times 4}{4 \times 384}$$

5th Multiply top, then bottom and divide the bottom into the top:

$$GPA = \frac{23760}{1536}$$

Gallons per Acre (GPA) = 15.5

8.3.2 Optional Equipment for the Trailer Unit

Options include: Tandem Axles, Fenders, Hose Reel (CA32112L) with 200 ft. of ½ hose and Hudson or Green Garde handgun.

8.3.3 Trailer Unit Speed Calibration Tables

Speed Calibration Table I
(Travel 88 feet)

Time	MPH	Ft./Minute
20.0	3	264
17.1	3.5	308
15.0	4.0	352
13.3	4.5	396
12.0	5.0	440

Speed Calibration Table II
(Travel 100 feet)

Time	MPH	Ft./Minute
22.7	3	264
19.5	3.5	308
17.0	4.0	352
15.2	4.5	396
13.6	5.0	440

8.4 Calibrating the De-icing System

8.4.1 Fundamentals of the De-icing System

The De-icing System is an option to the Herbicide Truck when ordered by GSD. The System can also be ordered through purchasing and installed by the District/Region Equipment Shops.

The De-icing System uses a material when applied on the road surface in a pre-ice situation, prevents ice from forming and in a de-icing situation, breaks down the ice on roadways and bridge structures which allows for the thawing of ice. In most cases all of this depends upon the type of solution used and the climatic conditions encountered.

The solution is applied through the De-icing System and its nozzles only preventing damage to other fluid handling components of the herbicide truck except for the pump.

De-icing materials used by TxDOT:

FreezGard or M1000, Meltdown Apex, Calcium magnesium acetate (CMA), Brine solutions and any other liquid product deemed to be effective in thawing or breaking down ice in an environmental and safe way on the roadway surface. Other methods include sanding and pelletized de-icing products distributed by broadcasters on dump trucks.

Nozzles for use on the De-icing System will be the SS0030-G (3 GPM) and SS0015-G (1.5 GPM) and the truck will have both sets of nozzles available for which material is used:

(Top and Bottom) SS0030-G nozzles – 3 GPM

(Top and Bottom) SS0015-G nozzle – 1.5 GPM

(Discontinued Bottom) RA 60 nozzles – 6 GPM

Standard guidelines for operating the herbicide truck with the De-icing System:

Spray speed is to be determined after calibration

Spray pressure is 40 psi

Maximum Spray width: 12 feet x 12 feet x 12 feet = 36 feet

8.4.2 Calibrating the De-icing System

$$MPH = \frac{60 \times GPM}{GPLM}$$

MPH = Miles per Hour

GPM = Gallons per Minute

GPLM = Gallons per Lane Mile

1) Measure material from nozzles and convert to GPM
2) Recommended Gallons per Lane Mile as listed on label of material

Example of how to get MPH using material for De-icing:

Note: 60 is a constant

$$MPH = \frac{60 \times GPM}{GPLM}$$

1) Measured material from De-icing System nozzles for one minute at 40 p.s.i and measured amount was 15 gallons or 15 Gallons per Minute,
2) Material label recommended application of 30 Gallons per Lane Mile,
3) Plugged in the numbers,

$$MPH = \frac{60 \times 15}{30}$$

4) Multiple top and divide bottom into top for MPH,

$$MPH = \frac{900}{30}$$

4) Miles per Hour (MPH) = 30

SECTION 9

9.0 PRECAUTIONS

Eye wash kits can be obtained from the regional warehouses

9.1 Precautionary Statements

All labels include precautionary statements. Always read the label for safety procedures before using chemicals. Most exposure to herbicides occurs during mixing operations, mainly to uncovered hands, forearms, and face. Exposure can be reduced significantly by wearing gloves, goggles and long sleeve shirts. Wash hands thoroughly after handling chemicals.

9.2 Do's and Don'ts While Applying Herbicides

- Read label prior to opening the container. Follow instructions and pay attention to precautions and warnings.
- Store products in original containers.
- With powdered herbicides, like ***Outrider®, Landmark® XP*** and ***Escort® XP***, hold the container inside the mouth of the tank and pour slowly. This will eliminate much of the dust blowing up from the tank.
- Do not use soil active products near desirable susceptible vegetation. In these areas use foliar applied products such as ***Roundup PROMAX®***.
- Dispose of herbicide containers according to label recommendations or recycle. Disposal usually consists of triple rinsing the container and punching holes in it rendering it useless.
- All of the herbicides can be left in the tank overnight, but should not be left for an extended period of time. The solution should be used up if an application is not scheduled for several weeks.
- ***Outrider®, Landmark® XP*** and ***Escort® XP*** are unstable in acidic water and should not be left in the spray tank for long periods of time. These products will also break down in high temperatures.

9.3 Equipment

When cleaning spray equipment, make certain that the chemical solution does not drain into areas of desirable vegetation or into waterways.
Do not save worn out tips for later use. Throw them away. Keep spares of each type of tip and several diaphragm check valves in the spray unit.
Prior to equipment storage over the winter season, flush tanks, boom, and hoses with several changes of water. Clean all tips and screens. Antifreeze can be circulated through the system to prevent the pump from freezing or locking down if it is not used for a long period.

9.4 Application Knowledge

- Drive at the correct speed.
- Discontinue spraying if wind velocity rises. **Winds above 5 mph may cause drift. All spraying must cease when patterns cannot be kept on target.** The applicator may need to begin application early in the morning, in order to cover as much area as possible, before the wind velocity rises.
- Discontinue herbicide application if rainfall in threatening. **Most of our herbicides are rainfast within 1-2 hours.** Postpone treatment until favorable conditions are present. Wet soil and/or foliage may yield poor results.
- Do not apply herbicides when ground is frozen.
- Avoid contaminating water in lakes or streams with herbicides, which are not labeled for use in water.
- Use only clean water in the tank. Sand or clay particles will damage the pump, solenoids, and nozzles, and will deactivate ***Roundup PROMAX®***.
- Clean equipment when changing chemicals. Flush with water several times and spray rinseate on the right of way as a typical application.

Emergency spill kits can be obtained from Regional Warehouses.

9.5 Procedures to Follow for a Herbicide Spill

All herbicide units should have an emergency spill kit with the trucks. Small spills should be contained with the spill kits. Large spills need to be contained as much as possible and contact the District Vegetation Manager or the Maintenance Division, Vegetation Management Section Office at (512) 416-3093 for cleanup instructions.

9.6 Preventing Lateral Movement of Soil Residual Herbicides

Lateral movement is the outward or side movement of a herbicide (several inches or feet) from the target area where it was applied. This occurs with soil residual herbicides when the applicator applies too high a rate of soil residual herbicide, when the soil is sandy, when the area sprayed is on a slope, or when rainfall moves the herbicide. To prevent lateral movement of herbicides use the following precautions:

- Apply at the proper rate.
- Reduce rates applied to sandy soils.
- Avoid application to slopes with soil residual herbicides.
- Do not apply during rain or when a heavy rain is expected.
- Do not apply to water-saturated soils.

SECTION 10

10.0 TOXICITY

10.1 Precautions

The objective of using herbicides is to control a particular vegetation problem without creating environmental or health hazards. All herbicides approved by the Department of Transportation for use in roadside vegetation management are classified as either **slightly toxic (rating 3) or almost non-toxic (rating 4)** in terms of the acute oral toxicity. They are also classified as either **mildly irritating (rating 3) or non-irritating (rating 4)** to the skin.

Nevertheless, safety equipment (eye protection, gloves, long sleeve shirt and dust mask where appropriate) should always be worn when working with concentrated herbicides or spray additives and when using the handgun or a backpack sprayer.

The following table relates the relative toxicity of TxDOT-approved herbicides as compared to commonly used items:

Common Name	Common Trade Names	Oral LD-50 (mg/kg)	Oral Toxicity Rating	Dermal Toxicity Rating
Aspirin	for comparison	1,240	3	-------
Table Salt	for comparison	3,320	3	-------
Table Sugar	Sucrose	29,700	4	4
Glyphosate	***Roundup PROMAX®***	>5,000	4	4
Sulfometuron methyl and Chlorsulfuron	***Landmark® XP***	>5,000	4	3
Sulfosulfuron	***Outrider®***	>5,000	4	4
Metsulfuron methyl	***Escort® XP***	>5,000	4	3
Fluroxypyr-meptyl	***Vista® XRT***	>5,000	3	3
Triclopyr	***Pathfinder II®***	>4,464	3	3
Clopyralid	***Transline®***	>5,000	4	4
Methoprene	***Altosid® XR***	34,600	4	4

An “Oral LD-50” is a measure of the concentration of a particular substance, which is necessary to kill 50 percent of the test animals. Oral LD-50 is normally measured in milligrams of the product per kilogram (parts per million) of body weight of the test animal.

Toxicity Categories

Indicators	Category			
	I **Poison**	**II** **Warning**	**III** **Caution**	**IV** **Caution**
Oral LD50 (mg/kg)	<50	50-500	500-5,000	>5,000
Dermal LD50 (mg/kg)	<200	200-2,000	2,000-20,000	>20,000
Eye Effects	Corneal Opacity, Irreversible Eye Damage	Corneal Reversible	No Corneal Opacity	No irritation
Dermal Response Rating Class	Absorbed, poisonous, causes burns and blisters	Moderately irritating	Mildly irritating	Non-irritating
Probable Lethal Dose for 150 lb. Man	A taste (less than 7 drops) to 1 teaspoon	1 teaspoon – 1 ounce	1 ounce – 1 pint	1 pint – 1 quart
Toxicity Rating Class	**Extremely Toxic**	**Moderately Toxic**	**Slightly Toxic**	**Almost Non-Toxic**

The LD-50 is applicable whether the chemical enters the body by inhalation, absorption through the skin or swallowed by the mouth. Generally, the LD-50 value for a material ingested via the respiratory route is lower than the oral LD-50 and the LD-50 by the dermal route. The higher the LD-50 value, the lower the toxicity of the chemical.

SECTION 11

11.0 PROTECTED PLANT SPECIES

11.1 Management of Protected Plant Species

Currently there are 16 protected plant species on the highway right of way, which affords protection under the "Endangered Species Act". This act is enforced by the Texas Parks and Wildlife Department and the US Fish and Wildlife Service. Two plants are a "Candidate Species", which means that there is an ongoing study to determine if the plant qualifies in the future for "Endangered" or "Threatened" protection. Two plants are not on any of the federal or state protection listing, but TxDOT is protecting these species because of their dwindling habitat.

All maintenance in these areas should be coordinated with the Vegetation Management Staff of the Maintenance Division and the Texas Parks and Wildlife Department. All maintenance in these areas should protect and preserve these protected plant species.

The following table lists these plant species, classification and county where they are located:

Species Name	Classification	County
Davis' Green Pitaya	Endangered	Brewster
Nellie Cory Cactus	Endangered	Brewster
Tobush Fishhook Cactus	Endangered	Kimble, Kinney, Uvalde, Val Verde
Zapata Bladderpod	Endangered	Zapata
Ashy Dogweed	Endangered	Zapata
Texas Trailing Phlox	Endangered	Hardin
Slender Rush Pea	Endangered	Kleberg, Nueces
Texas Poppy Mallow	Endangered	Runnels
Texas Wild-rice	Endangered	Hays
Navasota Ladies-tresses	Endangered	Brazos, Grimes
South Texas Ragweed or Ambrosia	Endangered	Kleberg, Nueces
Walker's Manioc	Endangered	Hidalgo
Pecos or Puzzle Sunflower	Threatened	Pecos
Lloyd's Mariposa Cactus	Threatened	Brewster
Neches River Rose Mallow	Candidate Species	Cherokee, Houston, Trinity
Texas Golden Glade Cress	Candidate Species	Sabine, Nacogdoches
Rough-stem Aster	Protected by TxDOT	Anderson, Henderson, Smith, Van Zandt, Wood
Bailey's Ballmoss	Protected by TxDOT	Kenedy

SECTION 12

12.0 LAWS AND REGULATIONS

12.1 Texas Department of Agriculture (TDA)

Application of all herbicides and spray additives will be made in a manner consistent with all current and pertinent laws and regulations. The current laws, regulations and agreements under which TxDOT must operate include:

- Texas Pesticide and Right-to-Know Laws and Regulations (TDA)
- Texas Department of Transportation and Texas Department of Agriculture Memorandum of Agreement 1995 (See Pages 27 - 28)

MEMORANDUM OF AGREEMENT

BETWEEN

THE TEXAS DEPARTMENT OF TRANSPORTATION

AND

THE TEXAS DEPARTMENT OF AGRICULTURE

I. **LEGAL AUTHORITY**

This agreement is entered into under Section 76.101(c) of the Texas Pesticide Law.

II. **PURPOSE**

The purpose of this agreement is to promote thoroughness of preparation and testing, efficient use of agency personnel, and maximum economy in expenditure of funds for pesticide applicator certification of Texas Department of Transportation (TxDOT) personnel. Because of the statewide public right-of-way and roadside park pest control responsibilities of the TxDOT, that agency and the Texas Department of Agriculture (TDA) find that a cooperative agreement to provide specialized training and testing of TxDOT pesticide applicators will also promote public safety, environmental protection, and effective use of pesticides. The two agencies enter into this Memorandum of Agreement subject to the following conditions:

III. **CONDITIONS**

1. TxDOT will develop training and testing material for certification of TxDOT personnel in the right-of-way pest control category. All training and testing materials shall be subject to TDA review and approval. TxDOT will designate qualified instructors to direct training and testing.

2. TxDOT shall provide TDA with a schedule of testing dates and locations.

3. To be licensed under TxDOT testing, a person must pass a General Pesticide Applicator Exam, a Laws and Regulations Exam, and a Right-of-way Pest Control Exam. In no case will a score below 70% be approved as passing. All tests shall be written and may not be administered orally. TxDOT personnel may also be certified in the Research and Demonstration, the Predatory Animal Control Category and any additional categories by successfully completing the appropriate TDA exams in addition to the exams listed above.

4. A license issued to TxDOT personnel shall be a noncommerical license with no fee charged; however, such license shall be valid only for purchase and/or application of pesticides in the line of official TxDOT duties.

5. Licenses may be renewed on an annual basis subject to recertification regulation requirements and must be surrendered upon termination of employment with TxDOT. TxDOT shall notify TDA of surrendered licenses.

6. TxDOT will develop recertification courses approved by TDA for TxDOT personnel. On or before December 15 of each year, TxDOT will submit to TDA a record of TxDOT personnel who have successfully met the recertification requirements for licensing the following year.

7. TxDOT personnel may also receive recertification credits as otherwise provided by 4 TAC Section 7.10.

IV. **NOTIFICATION OF VIOLATIONS**

TxDOT and TDA each agrees to notify the other agency of any incident or complaints of pesticide misuse by TxDOT personnel. TDA shall notify TxDOT of any suspension or revocation of a license or certification of TxDOT personnel for pesticide misuse or other cause.

V. **TENURE**

This agreement shall remain effective until canceled by either of the signatory parties or their authorized agent and may be subject to review and amendment as deemed necessary or appropriate as mutually agreed.

SIGNATORY PARTIES

Assistant Executive Director
for Field Operations
Texas Department of Transportation

October 25, 1995
Date

Deputy Commissioner,
Texas Department of Agriculture

10-9-95
Date

SECTION 13

13.0 HERBICIDE SPRAYING OPERATIONS

13.1 General Information

The purpose of the herbicide spraying operation is to control noxious and invasive plants that may cause a safety concern compete with desirable vegetation on the right-of-way and are detrimental to the environment. Also an effective spraying program has been shown to reduce mowing cycles, mowing cost and improve the overall condition of the highway system.

It is very important that application timing guidelines are followed to ensure that spraying operations do not affect the emergence and growth of wildflowers.

Please refer to Sections 15.1.6, Section 15.3.1 and Section 15.4.3.

Herbicide spraying operations must be coordinated with mowing operations to be effective.

13.2 Bare ground Applications

Bare ground applications are herbicide treatments to the edge of pavement and vegetation encroachment within paved shoulders, retaining walls and paved and raised medians. The recommended application rate for these treatments is 3 quarts of Roundup PROMAX® plus Landmark® XP at 2 ounces per acre to provide for short term control of edges and 3 ounces per acre of Landmark® XP for extended control of vegetation. These applications are generally made from March thru September. The most effective applications to control bermudagrass are generally made later in the recommended spray schedule.

These applications should be restricted to no more than 6 inches from to the edge of the paved surface and 12 inches behind the guardrail. Applications wider than 12 inches may result in erosion and soil sediment loss.

Reference: Section 4.1, Section 7.3, Section 14.7, Section 15.1.11, Section 15.2

13.3 Guardrail Applications

The recommended herbicides and application rates are 8 ounces of Roundup PROMAX® plus 1.33 ounces of Outrider® plus 1 ounce of Escort® XP plus 6 ounces of Vista® XRT per acre. These applications are generally made from May thru October.

Herbicide applications to control winter annuals (such as ryegrass, mustards and turnip weed) are recommended in the spring to improve visibility of guardrails. The application rate for these treatments is 12 ounces of Roundup PROMAX® plus 2 ounces of Landmark® XP per acre. These applications are made January thru April.

13.4 Noxious Weed Control

Broadcast herbicide applications are required to control noxious weeds on the right-of-way such as Johnsongrass, Switchgrass, Giant Ragweed, Sunflowers, Field Bindweed and other broadleaf weeds. The recommended herbicides and application rates are 8 ounces of Roundup PROMAX® plus 1.33 ounces of Outrider® plus 1 ounce of Escort® XP plus 6 ounces of Vista® XRT per acre. These treatments are also recommended to treat

guardrails, signs and delineators when grasses are desired around and under these structures. Applications are generally made from May thru October, however, Escort XP should be discontinue after July 31.

Reference: Section 4.2, Section 7.4, Section 7.5, Section 14, Section 15.3.1, Section 15.5.2, Section 15.6.4, Section 15.8.3

Broadcast and spot applications of Transline® in the spring (January thru April) may be necessary to control Musk Thistle. Applications rates are 10 ounces per acre applied as a broadcast application and 10 ounces per 100 gallons of water for spot treatments. Spot applications are recommended in areas where large populations of wildflowers exist.

Reference: Section 7.8, Section 15.6.2

In some cases, it will be necessary to make herbicide applications with the handgun to noxious plants that can not be sprayed with broadcast application equipment. To determine the proper herbicide application rate, find recommended rate per acre in this manual or in the manufacturer's chemical label. Add the recommended rate of the chemical to 100 gallons of water for handgun use. In many instances, surfactant is also recommended.

Reference: Section 15

13.5 Brush and Tree Control and Chemical Pruning

Low volume foliar and basal bark herbicide applications will be necessary to control brush and trees such as Mesquite, Huisache, Retama, and Kudzu on the right-of-way.

Low volume foliar treatments are made using a solution of ½% Transline® plus 1/2% surfactant applied with a handgun equipped with a X-6 spray tip. The application should be made uniformly over the entire plant. These treatments are generally made in mid-summer thru fall.

Chemical Prune woody plants and tree limbs encroaching in the clear zone on the state's right-of ways with the herbicide ***Milestone® VM Plus.*** With the flex-5 spray head woody plants can be controlled with ***Milestone® VM Plus***, at 6 pints per acre plus surfactant at the rate of ½%. ***Milestone® VM Plus*** can be applied at anytime during the growing season when the woody plants are actively growing with adequate foliage.

In areas where there are a lot of undergrowth around the trees that would otherwise need to be trimmed mechanically add ***Vista® XRT***, at 6 ounces per acre to the ***Milestone® VM Plus***, at 6 pints per acre plus the addition of surfactant at the rate of ½%.

Reference: Section 7.8, Section 14.8, Section 14.9, Section 14.10, Section 14.21, Section 15.6.4, Section 15.6.5, Section 15.6.6, section 15.6.7, Section 15.6.8.

Basal bark herbicide applications can be made year-around using the ready-to-use herbicide, Pathfinder II®. Apply Pathfinder II® to the lower 12-15 inches of bark using an X-1 or X-2 spray tip.

Reference: Section 15.7.2

13.6 Aquatic Weed Control

Handgun herbicide applications are often necessary to control aquatic vegetation. Aquamaster® applied at 8 quart plus 2 quart of an aquatically approved surfactant per 100 gallons of water is recommended to control undesirable vegetation growing in standing or running water.

Reference: Section 7.6, Section 15.4

SECTION 14

14.0 NOXIOUS WEEDS ON THE RIGHT-OF-WAY

14.1 General Information

A variety of plants are considered pests along the highway right of way. Pest plants are generally those species, which pose either safety, maintenance, or public relation problems for the Department.

The predominant pest species in Texas include Johnsongrass, Giant Ragweed, Musk Thistle, Sunflower, Field Bindweed, Bermuda grass, Mesquite, Huisache, Retama, Georgia Cane, Kochia, Russian Thistle, Switchgrass, Turnip Weed, Morning Glory Vine, Western Bitterweed, African Rue, Cattails, Saltcedar, Wildoats, Jointed Goatgrass and Kudzu.

Some of these are native to Texas; others are introduced species, which have become naturalized, taking advantage of environmental disturbance to invade and become established in the highway right of way. Minimizing disturbance caused by construction or maintenance activities is the best way to reduce the spread of such species. However, once these species becomes established in an area of the right of way which must be maintained, properly selected and applied herbicides may be used to control the pest and to re-establish desirable vegetation.

This section addresses important characteristics of the major pest plants of concern to the Department, and the recommended methods for their control.

14.2 Johnsongrass

Johnsongrass (Sorghum halepense) is a perennial grass, which may grow to approximately six feet tall. It spreads vigorously by rhizomes (i.e. underground runners) and by seed. It flowers throughout the growing season under favorable growing conditions. Most Johnsongrass plants, however, mature and flower later in the growing season. Johnsongrass is commonly found growing along roadsides, in ditches, open areas, fields and waste places.

Johnsongrass is most effectively controlled in an overspray program either with ***Roundup PROMAX®*** **+** ***Escort® XP+ Outrider®*** until July 31st or with ***Roundup PROMAX® + Outrider®*** alone later in the growing season until October 15th. Johnsongrass around fixtures may be controlled by spraying the ***Roundup PROMAX® + Escort® XP+ Outrider®*** combination at any time during the growing season.

In areas where Johnsongrass and Bloodweed control are necessary, ***Outrider®*** and ***Roundup PROMAX®*** can be mixed with 6 oz/ac of ***Vista® XRT.*** The Bloodweed must be actively growing with adequate soil moisture to achieve the best results.
Also see Sections 15.1.5, 15.3.1.1, 15.3.1.2 and 15.3.2.1.

14.3 Giant Ragweed (Bloodweed)

Giant Ragweed (Ambrosia trifida) is an annual broadleaf weed that can obtain heights of over ten feet. The plant germinates in the spring and flowers in the fall. The flowers are small and inconspicuous. The plant is blamed for hay fever problems while it is blooming.

Normally growing in the eastern two-thirds of the State it generally prefers moist soil in and around ditch areas.

Giant Ragweed can be controlled with an application of ***Vista® XRT*** at 6 ounces per acre rate plus surfactant at the rate of 2 quarts per 100 gallons of water in late spring-early summer. **Spraying mature plants will yield poor results.**

In areas where Johnsongrass and Bloodweed control is necessary, ***Outrider®*** and ***Roundup PROMAX®*** can be mixed with ***Vista® XRT*** at the 6 oz/ac rate without surfactant. The Bloodweed must be actively growing with adequate soil moisture to achieve the best results. *Also see Sections 15.3.1.2 and 15.8.3.*

14.4 Musk Thistle

Musk Thistle (Carduus nutans) is a biennial plant, which can grow up to eight feet tall. Musk Thistle takes two years to mature and die. The first year the plant is a rosette, as illustrated in the photo, the second year the plant grows tall and blooms. The leaves are dark green, deeply lobed, hairless and have a light green mid-rib. A silver gray leaf margin is characteristic of each spine tipped lobe. The leaf base extends down the stem to give the plant a winged appearance. The terminal flower is large (one to three inches in diameter), solitary and usually nodding or bent over slightly. The flowers are purple and are "powder puff" shaped producing thousands of straw-colored seeds per plant. Seed dispersal begins seven to ten days after blooming. The seeds are attached to parachute-like hairs (pappus) which allow for their dispersal by wind currents.

Musk thistle reproduces only by seed so it's very important to control this plant before it goes to seed. It grows from the Panhandle to Central Texas. It can become a serious agricultural pest as well as causing safety problems for the Department.

Control of Musk Thistle can be obtained with an application of ***Transline®*** at 10 ounces per acre rate applied early spring (March - April).

14.5 Sunflower

Sunflowers (Helianthus annuus) are a drought tolerant annual broadleaf weed, which may reach a height of eight to ten feet. Yellow daisy-like flowers with dark centers grow two inches across. Multi-stemmed plants grow irregularly and are common throughout the state on roadsides, but usually occur in disturbed areas.

Sunflowers are a common weed problem that quickly emerges after construction projects are over, especially when new topsoil is added to the right of way from outside sources when stockpiled topsoil is depleted.

Sunflowers can be controlled with an application of ***Transline***® at 10 ounces per acre or with the herbicide ***Escort***® ***XP*** at the rate of 1 ounce per acre plus surfactant at the rate of 1 quart per 100 gallons of water. Plants should be sprayed when they are 2-3 feet in height.

14.6 Field Bindweed

Field bindweed (Convovulus arvensis) is a long-lived perennial which produces a dense ground cover. The twining stems vary from 1.5 to 6 feet or more in length. It produces white to pink flowers, from April through September, and seeds, which may lie dormant in the soil for 30 to 40 years.

Field Bindweed occurs from the Panhandle to Central and West Texas along roadsides, railroads, fields, gardens and waste places and is a serious agricultural pest. Field Bindweed invades and becomes rapidly established in disturbed areas; minimizing disturbance in the right of way will reduce the spread of this pest plant.

The most effective herbicide to control Field Bindweed is ***Escort***® ***XP*** applied at a rate of 1 ounce per acre during the flowering period. Always add 1 quart of surfactant per 100 gallons of water.

14.7 Bermudagrass

Bermudagrass (Cynodon dactylon) is a low-growing, perennial grass, which spreads mostly by underground and above ground runners, although common Bermudagrass produces viable seed. This plant grows primarily in loamy, seasonally moist soils; it is commonly found on highway roadsides. Although, Bermudagrass is a valuable cover species, reducing erosion, it is a potential pest when it grows into the pavement. Bermudagrass often penetrates the pavement shoulder contributing to pavement breakdown.

Bermudagrass growing at the edge of pavement is generally best controlled by an early fall application of ***Roundup PROMAX®*** at 3 quarts plus ***Landmark® XP*** at a 2-3 ounces per acre rate.

Bermudagrass growing in riprap and on concrete fixtures is generally best controlled with an application of ***Roundup PROMAX®*** at 3 quarts per acre rate. ***Landmark® XP*** is left out of this solution due to the possible runoff onto desirable vegetation after rainfall.

Applications should be restricted to no more than 6 inches from the edge of the paved surface and 12 inches behind the guardrail. Applications wider than 12 inches may result in erosion and sediment loss.

14.8 Mesquite

Mesquite (Prosopis glandulosa) grows either as a shrub or a tree and is abundantly armed with stiff spines. The plants usually flower in the spring, but sometimes later. The flowers are very small and grouped together in conspicuous, yellowish bunches. Mesquite is widely distributed in the western half and southern Texas, generally in deep soils. It increases in abundance in disturbed grasslands.

Mesquite, where it occurs in areas of the right of way, which must be maintained, may be mowed annually at the time of the fall full-width mowing. Alternatively, where the plants are large enough or the need of removal is necessary, the herbicide ***Pathfinder II®*** can be applied as a low volume application, or with the herbicide ***Transline®***, at 21 ounces per acre plus 2 quarts surfactant per 100 gallons of water, applied in mid-summer to early fall.

14.9 Huisache

Huisache (Acacia farnesiana) is a brushy species, which occurs as both shrubs and trees, usually with several trunks. The branches are numerous and armed with many paired, pin-like, pale spines. The fragrant yellow flowers are clustered in small spheres. The plants flower in the spring, but many produce flowers again after rain during periods of drought.

Huisache is primarily found in South Texas, extending north to Travis County and northwest to Brewster County.

Huisache, where it occurs in areas of the right of way, which must be maintained, may be mowed annually at the time of the fall full-width mowing. Alternatively, where the plants are large enough or the need of removal is necessary, the herbicide ***Pathfinder II***® can be applied as a low volume application at any time of the year, or with the herbicide ***Transline***®, at 21 ounces per acre plus 2 quarts surfactant per 100 gallons of water, applied in mid-summer to early fall.

14.10 Retama

Retama (Parkinsonia aculeate) generally occurs as a small, widely branching tree with sharp, slightly curved spines on green barked branches. The flowers are yellow, and are identifiable as distinct, individual flowers (unlike Mesquite and Huisache). The plant may flower Spring through fall, depending on location and climate.

Retama is distributed throughout the South Texas region, extending northward to at least Williamson County and east to Brazos County.

Retama, where it occurs in areas of the right of way, which must be maintained, may be mowed annually at the time of the fall full-width mowing. Alternatively, where the plants are large enough or the need of removal is necessary, the herbicide ***Pathfinder II***® applied as a low volume application at any time of the year. Control can also be achieved with ***Transline***® at 21 ounces per acre plus 2 quarts surfactant per 100 gallons of water, applied in mid-summer to early fall.

14.11 Georgia Cane or Giant Reed

Georgia Cane (Arundo donax), also known as Giant Reed and Wild Cane, is a tall, perennial grass that can grow to over twenty feet in height. Its fleshy, creeping rootstocks form compact masses from which tough, fibrous roots emerge that penetrate deeply into the soil. Leaves are elongate, one to two inches wide and a foot long. The flowers are borne in two foot long, dense, plume-like panicles during August and September. Georgia Cane is found throughout the state of Texas along ditches, streams and roadsides.

Georgia Cane was probably first introduced into the United States at Los Angeles, California in the early 1800's. Since then, it has become widely dispersed into all of the subtropical and warm temperate areas of the world, mostly through intentional human introductions along ditches for erosion control. Introduced from India.

Georgia Cane is controlled with an ***Approved Aquatic Herbicide*** at a 2 % or 8 quarts/100 gallons of water solution using a handgun. Always add 2 quarts of surfactant to each 100 gallons of water.

14.12 Kochia and Russian Thistle

Kochia (Kochia scorparia), a member of the Goosefoot family, was introduced from Europe and is an annual, reproducing by seed, which can grow up to six feet tall. Kochia can be found in cultivated fields, waste areas and roadsides.

Russian Thistle or Tumbleweed (Salsola iberica) is also a member of the Goosefoot family was introduced from Russia and is an annual, which reproduces by seed. Mature plants are spherical bushes up to five feet tall. After they turn grayish brown in the fall, the plants break away from the roots at the soil line becoming tumbleweeds that scatter their 250,000 seeds per plant in their path.

Kochia and Russian Thistle normally grow in the northern and western half part of the state.

Control of Kochia can be obtained with an application of ***Vista® XRT*** at 6 ounces per acre rate plus surfactant at the rate of 2 qts. per 100 gallons of water applied early spring or on actively growing plants.

Control of Russian Thistle can be obtained with an application of ***Vista® XRT*** at 6 ounces plus ***Escort® XP*** at 1 ounce per acre rate plus surfactant at the rate of 2 qts. per 100 gallons of water applied early spring or on actively growing plants.

14.13 Switchgrass

Switchgrass (Panicum virgatum) is a native, warm-season, perennial tall bunchgrass that grows from two to seven feet tall. Leaf blades are four to twenty-four inches long and .2 to .6 inches wide. Switchgrass flowers from August through September. Switchgrass roots can sometimes reach down ten to eleven feet deep. Very palatable by livestock.

Its large size and growing habit cause sight distance issues on the right-of-way.

Control of Switchgrass can be obtained by spot treating clumps using the herbicide ***Roundup PROMAX®*** in a 1.5 % solution with water applying this solution with a handgun or pump-up sprayer. Another method would be to use a ***Rotowiper®*** application system with a 25 % ***Roundup PROMAX®*** solution in water.

14.14 Guinea Grass

Guinea Grass (Panicum maximum) is an introduced, warm-season bunchgrass from Africa. Deep, dense fibrous root system withstands drought conditions, but prefers south Texas. Grow over 6 feet tall with long, narrow, fine, soft leaves.

Its large size and growing habit has become a pest on the right-of-way.

Control of Guinea Grass can be obtained by spot treating clumps using ***Roundup PROMAX®*** in a 1.5 % solution with water applying this solution with a handgun or pump-up sprayer. Another method is by overspraying with the Flex-5 spray head the herbicide ***Roundup PROMAX®*** at a rate of 10 ounces per acre solution in water.

14.15 Chemical Pruning

Chemical Prune woody plants and tree limbs encroaching in the clear zone on the state's right-of ways with the herbicide ***Milestone® VM Plus.*** With the flex-5 spray head woody plants can be controlled with ***Milestone® VM Plus***, at 6 pints per acre plus surfactant at the rate of ½%. ***Milestone® VM Plus*** can be applied at anytime during the growing season when the woody plants are actively growing with adequate foliage.

In areas where there are a lot of undergrowth around the trees that would otherwise need to be trimmed mechanically add ***Vista® XRT***, at 6 ounces per acre to the ***Milestone® VM Plus***, at 6 pints per acre plus the addition of surfactant at the rate of ½%.

Note: The herbicide ***Milestone® VM Plus*** at 9 pints per acre is the maximum rate per year.

14.16 Turnip Weed

Turnip Weed or Bastard Cabbage (Rapistrum rugosum) is an annual, many-branched, herbaceous plant that grows from one to five feet or more in height and has a taproot that can become quite large. Leaves are deep green, lobed and wrinkled, and sometimes have a reddish cast. The terminal lobe is larger than the lateral lobes, especially on the basal leaves. Younger leaves growing higher up on the plant are less lobed and more elongated. Turnip Weed typically flowers from early spring into summer, bearing clusters of small, showy yellow flowers at the tips of its branches, resembling those of broccoli and cabbage. Turnip Weed can be identified more easily and certainly by its unusually shaped fruit - a two-segmented seed capsule, called a silique. The seed capsule is stalked, with a long beak at the tip, and contains one to two seeds. The seeds are tiny, oval-shaped, dark brown and smooth.

Turnip Weed is one of the first plants to emerge in the spring and since it is faster growing than most spring wildflowers it grows alongside competing for moisture, nutrients and sunshine causing problems on the roadside where it exists.

Turnip Weed can be controlled by using the herbicide ***Escort® XP*** at a rate of 1 ounce per acre rate early in the spring. Always add 1 quart of surfactant per 100 gallons of water.

14.17 Morning Glory Vine

Morning Glory Vine (Ipomoea purpurea), related to Field Bindweed (Convovulus arvensis) and Sweet Potato, forms twining vines with bell-shaped flowers, and its varieties have also become intertwined botanically under the name "morning glory." The name comes from the flowers, which last a single day. Flowers are white, blue, pink, purple, red, and multicolored.

The vines grow quickly to ten feet or more only two months after seeds sprout. The leaves are heart-shaped, and the flowers are normally open from dawn to midmorning, then closing.

Morning Glory Vine has become a pest plant on the right of way twining up into signs, delineators, bridge structures, guard rails, barrier fences and landscaped shrubbery.

The most effective way to control Morning Glory Vine is with the herbicide ***Escort® XP*** applied at a rate of 1 ounce per acre during the flowering period. Always add 1 quart of surfactant per 100 gallons of water.

14.18 Western Bitterweed

Western Bitterweed (Hymenoxys odorata) is an erect, annual, composite plant growing from three inches to two feet tall. Stems are purplish near the base. Leaves are alternate and usually woolly underneath. Bright yellow flowers bloom from April through June and occasionally in the fall. This plant has a bitter taste and a distinct odor. Bitterweed is toxic to sheep and is generally unpalatable.

Western Bitterweed is located throughout the western portion of the State in various counties and being concentrated in the Trans-Pecos region of Texas.

Western Bitterweed readily invades disturbed areas, but seems to be largely excluded from areas where native vegetation persists. Curtailing disturbances in the right of way will likely restrict the spread of this pest species.

Western Bitterweed can be controlled by using the herbicide ***Escort® XP*** at the 1 ounce per acre rate plus 1 quart of surfactant per 100 gallons of water. Control of Western Bitterweed can be accomplished by overspray application or by spot spraying small concentrations of Western Bitterweed with the handgun sprayer.

14.19 African Rue

African Rue (Peganum harmala) is a perennial plant with a rounded tuft of fleshy stems from a twisting, woody root. The flowers are white to pale yellow appearing from April through November. Each flower produces a small marble-sized capsule, which is filled with seeds.

African Rue reportedly occurs in Edwards and Garza counties though it is most abundant in the Trans-Pecos region of Texas. This plant is reportedly poisonous to livestock.

African Rue is extremely aggressive and readily invades disturbed areas, but seems to be largely excluded from areas where native vegetation persists. Curtailing disturbances in the right of way will likely restrict the spread of this pest species.

Currently, the most effective means of controlling African Rue is with an application of the herbicide ***Escort® XP*** at a rate of 3 ounces per acre while the plant is flowering. Always add 1 quart of surfactant per 100 gallons of water.

14.20 Cattails

Cattails (Typha latifolia) are perennial aquatic plants, which may grow to ten feet tall from the creeping root to the tip of the flowering stem. The flowers are extremely small and are clustered together in a cylindrical, brown tuft. The flowers usually develop from March through May.

Cattails are scattered throughout Texas in roadside wetlands, drainage areas, marshes, streams and other shallow water areas impeding drainage.

Cattails and other associated aquatic vegetation are controlled with an ***Approved Aquatic Herbicide*** at a 2 % or 8-quarts/100 gallons of water solution using a handgun. Always add 2 quarts of surfactant to each 100 gallons of water.

14.21 Saltcedar

Saltcedar (Tamarix ramosissima), grows five to twenty feet tall. Smooth woody stems are reddish brown, turning gray and cracked as the tree ages. Leaves are small, scale-like, and give the slender stems a wispy green appearance. Flowers are pink to white, blooming from spring through late summer. They are very attractive and from a distance look like pink feathers at the end of the stems. Range is generally in the western part of the state of Texas along streams and rivers. Introduced from Eurasia.

Saltcedar is a small, shrubby tree and is often referred to as Tamarisk. It was introduced as an ornamental and was also used for stream bank erosion stabilization. Saltcedar has naturalized throughout the desert southwest, particularly along waterways and in wetlands. It is well adapted to salty, alkaline soils, to temperature extremes and to windy sites. Its aggressive root system uses much ground water (one plant draws and transpires 200 gallons of water per day from ground, stream or river), out competing native species.

Saltcedar is controlled with ***Habitat®* Herbicide** at 2-quarts per acre overspray or 2-quarts per 100 gallons of water solution using a handgun. Always add 2 quarts of surfactant to each 100 gallons of water.

Contact the Vegetation Management Staff of the Maintenance Division for specific recommendations for controlling Saltcedar.

14.22 Wildoats and Jointed Goatgrass

Wildoats (Avena fatua) and Jointed Goatgrass (Triticum turgidum) are two annual cool season grasses spread only by seed, which often occur on the right of way in North Texas. The seed germinate in the fall or winter. For this reason, an early application of ***Roundup PROMAX*®** (usually late March) at 10 ounces per acre as an overspray is effective in controlling these plants where it is necessary to do so.

14.23 Itchgrass

Itchgrass (Rottboellia cochinchinensis), is an annual, erect, up to 9 foot tall grass. Culms are supported by prop roots, nodes smooth, leaf sheaths are smooth or with sparse tubercular-based hairs. Leaf blades are straight to broadly straight, apex slender, smooth or with sparse tubercular-based hairs. Flowers 1-6 inches long, terminating with several reduced spikelets; directly attached spikelets and seed bearing spikelets. Native to the Philippines and in the 1920's introduced into Florida as a potential pasture grass. Later it spread into Texas by shipments of grass seed containing small amounts of this noxious weed in the bags. Itchgrass can be controlled by using a spot treatment of Roundup ProMax in a 1.5 % rate of water while actively growing. Another method is by overspray with the Fixture boom or Flex-5 spray head the herbicides ***Roundup PROMAX®*** and ***Landmark XP®*** at a rate of 12 ounces plus 2 ounces per acre solution in water.

14.24 Kudzu

Kudzu (Pueraria lobata) is an aggressive perennial, trailing or climbing vine of the legume family. A dense stand of identically colored plants growing on and around everything in its path is a familiar field mark.

Rarely flowering, kudzu stems and roots spread out in all directions from starchy fibrous root crowns, with new plants beginning at stem nodes every one to two feet. This dense packing of Kudzu can result in tens of thousands of plants occupying a single acre of land. Leaves are dark green and hairy beneath, often tri-lobed, and in groups of three on the vine. The ½ to ¾ inch elongated purple flowers with a fragrance reminiscent of grapes are pea-like in shape and are produced on plants exposed to direct sunlight. Kudzu fruits, present in October and November, are hairy, bean-like pods which produce only a few viable seeds in each pod cluster. It is thought that some seeds can remain dormant for several years before they germinate.

During peak growing season in early summer, this prolific vine can grow at a rate of a foot a day, easily covering and choking trees and under story vegetation.

Range consists of small pockets in the far eastern counties of the State with one infestation being eradicated by the Colorado River in south Austin. Introduced from Japan.

Kudzu is controlled with ***Transline®* *Herbicide*** at 21 ounces per 100 gallons of water solution using a handgun. Always add 2 quart of surfactant to each 100 gallons of water.

14.25 Other Right of Way Pests

Applications of all pesticides for the control of right of way pests including, but not limited to, burrowing rodents, fire ants, other destructive insects, etc. must be made in a manner consistent with all current and pertinent laws and regulations as established by the Texas Department of Agriculture and the Structural Pest Control Board. All label directions must be followed in detail.

Contact the Vegetation Management Staff of the Maintenance Division for specific recommendations.

SECTION 15

15.0 APPROVED CHEMICALS FOR RIGHT OF WAY VEGETATION MANAGEMENT

15.1 Roundup PROMAX® (Replaced Roundup® Pro)

15.1.1 General Characteristics

Roundup PROMAX® is a herbicide which may be used effectively in many applications within TxDOT's maintenance activities. These applications include pavement edge treatment to prevent the destruction of pavement, treatment around signs, delineators and guardrails, and to control Johnsongrass. Packed in 1.67 gallon jugs, 2 per case and 45 cases per pallet.

Roundup PROMAX® is a non-selective, foliar-applied, post-emergence herbicide which provides broad-spectrum control of many grasses and broadleaf plant species. Consequently, it is important to avoid application of this chemical onto the green portion of any desirable plant. The chemical is absorbed through the green leaf surface (or through green bark) and then translocated into the root system.

The best time to apply ***Roundup PROMAX®*** is when the plant species is green and actively growing. This will ensure maximum movement of the chemical into the root system.

Roundup PROMAX® has no soil residual activity, is non-volatile (does not form a gas), and is relatively low in toxicity to animals. As ***Roundup PROMAX®*** does not move within the soil, the likelihood of damage to nearby desirable plants due to root uptake of the chemical is slight. However care must be taken to prevent the drift of spray particles and to prevent accidental foliar application onto desirable vegetation.

15.1.2 Effects of Roundup PROMAX® Application during Dry Weather

High temperatures, prolonged periods of dry weather, and lack of soil moisture tend to force many plant species (e.g. Johnsongrass) into a state of semi-dormancy. When these conditions exist, plant growth slows in order to conserve available moisture and food reserves. With reduced energy production, movement of food within the plant is also reduced and very little food is moved into the plant's root system. Since ***Roundup PROMAX®*** acts directly upon the plant's root system, the application of the chemical during these conditions would yield poor results.

15.1.3 Effects of Roundup PROMAX® Applications

Applications of ***Roundup PROMAX®*** should generally be discontinued after the first killing frost. After this initial killing frost, warm-season plant species such as Johnsongrass become dormant for the winter and their leaves turn yellow or brown. Any application of chemical during this period will yield poor results since there is little or no movement of food from the foliage into the root system.

Do not apply ***Roundup PROMAX®*** if rainfall is imminent. Rainfall within 30 minutes after application will wash the chemical from the leaves and reduce the effectiveness of the application.

Roundup PROMAX® does not volatize (form a gas or vapor) and drift onto non-target areas and cause damage. Because of this factor, the chemical may safely be utilized within urban areas. However care must be taken to prevent spray or drift onto the foliage of desirable plants. Drift normally occurs when the spray pressure is too high for the nozzle tips being used, or when spraying in windy conditions. Do not apply ***Roundup PROMAX®*** at higher than recommended spraying pressure or during windy conditions. Always use the correct nozzle tips (See Section 5), and always use the appropriate drift control agent (See Section 7).

Do not spray the bark of young trees when the bark is green. ***Roundup PROMAX®*** may enter the tree through the green bark and cause injury to the plant's root system. On older trees where the bark is no longer green, ***Roundup PROMAX®*** may be applied to the tree base without risk of injury.

Always mix ***Roundup PROMAX®*** with clean water. Canal, creek and pond water may contain soil particles that can reduce the effectiveness of the chemical and can damage spray equipment. Hard water may also reduce the effectiveness of ***Roundup PROMAX®***.

Do not mix ***Roundup PROMAX®*** in galvanized containers. The chemical reacts with Zinc, forming a hydrogen gas, which may explode. Always use fiberglass or stainless steel backpack or hand-held sprayers. There is no danger when using the chemical in our herbicide spray units.

15.1.4 Application Procedures for Roundup PROMAX® - Fall Application

- Johnsongrass should be actively growing and have adequate leaf area before application;
- Correct nozzle tips (See Section 5) must be used;
- Mix ***Roundup PROMAX®*** in water according to the quantities the spray unit actually dispenses (See Calibration Formula, Section 8);
- When using the herbicide spray unit, vehicle speed should be maintained at the speed used in the calibration procedure, and the proper spraying pressure must be maintained (See Section 8);
- Apply the spray uniformly to the foliage of the plant. Nozzles are spaced to cover plant foliage evenly. Plant foliage should appear wet and glistening after application; and
- Delay mowing the treated area until 10 days after application. This will permit adequate movement of the chemical into the root zone.

15.1.5 Use of Roundup PROMAX® for Johnsongrass Control (Bermuda Release)

The Bermuda release program seeks to reduce infestation of Johnsongrass and to encourage the growth of desirable grasses including Bermuda grass.

To effectively control Johnsongrass, ***Roundup PROMAX®*** must be applied uniformly to the leaves of the plant. ***Roundup PROMAX®*** has no soil activity or residual, therefore direct foliar application is required for control.

Johnsongrass is most effectively controlled by an application of ***Roundup PROMAX®*** + ***Escort® XP + Outrider®*** during the summer before July 31st or a combination of ***Roundup PROMAX®*** + ***Outrider®*** can be applied later on before October 15th or in Bahiagrass areas. In the spring most of the growth activity is directed upwards away from the root zone. Food energy, stored in the roots during the previous fall, is being moved upward to produce new foliage and seed.

The plant will then move the chemical downward into the root system along with the food energy the plant is producing, thereby destroying the root system and the plant.

If ***Roundup PROMAX®*** is applied in the spring of the year, the results achieved will not be as successful as applications made during the late summer or early fall with the combination above.

Johnsongrass should be controlled when it is actively growing and there is adequate leaf area to spray before it gets exceedingly tall.

The ideal time to apply Roundup PROMAX® is when the plant is actively growing and is manufacturing food for storage in the plant's root system.

15.1.6 Flex 5 Spray Unit (GSD Issue)

The application procedure for effective Johnsongrass control with the Flex 5-spray unit:

Step	Action	Remarks
1.	Check equipment, nozzles and switches to ensure proper operation.	Adjust/repair as necessary.
2.	Calibrate Nozzles	At Standard Operating Pressure of 30 psi to apply 25 gallons per acre, at 11.4 mph. an electronic monitor on the control console will indicate Speed. The monitor is calibrated to the truck's transmission.
3.	Add appropriate amount of chemical	The ***Roundup PROMAX®, Escort® XP*** and ***Outrider®*** combination can be applied until July 31st. Then after July 31st use the ***Roundup PROMAX®*** and ***Outrider®*** combination until October 15th or in Bahiagrass areas.
4.	Add proper drift control agent.	See Section 7.

Caution! Do not use the ***Roundup PROMAX®, Escort® XP and Outrider®*** combination until wildflowers have set mature seed.

Applying the three-way herbicide mix will prevent initial brownout of targeted weeds for a more aesthetic looking right-of-way. After 2 weeks following the application, dieback of targeted weeds will begin gradually in most cases and at this time the treated area may be mowed.

15.1.7 Calibration Procedure for Roundup PROMAX®, Water and Drift Control Agent for ALL HERBICIDE SPRAY UNITS WITHOUT COMPUTER INJECTION

It is difficult to determine a single mixture ratio, which would satisfy the need of all spray units since there is wide variation in output from one unit to the next. Therefore, to determine the proper mixing ratios, follow the calibration procedure below:

Step	Action	Remarks
1.	Collect Spray emitted from the nozzles typically used, the two outside nozzles (2508 & 6508) and the edge nozzle (6508).	Add drift control agent. Collect the spray from each nozzle for a period of 60 seconds.
2.	Adjust spray patterns to insure adequate and uniform coverage.	Water and Drift Control only.
3.	Measure spray width of all nozzles and determine actual gallons per acre sprayed.	Use Calibration formula.
4.	Find Average Gallons Per Acre (GPA).	Divide GPA into the volume of water to find the number of acres to spray and then calculate the correct rate of ***Roundup PROMAX®*** to add per acre. Complete control (bare ground) rate = 3 quarts ***Roundup PROMAX®*** and 2-3 ounces of ***Landmark® XP*** per acre.

15.1.8 Roundup PROMAX® Applications in Chemical Mowing for TREATING AROUND DESIRABLE TREES AND SHRUBS

Roundup PROMAX® is not active in the soil and cannot be absorbed by the root system of desirable plants. Accordingly, the chemical may be applied to the foliage of weeds and unwanted grasses located underneath desirable trees and shrubs without harm to the desirable plant. This procedure may have benefit in landscaped areas and within picnic areas.

15.1.9 Roundup PROMAX® for Control of Switchgrass

Control of Switchgrass can be obtained by spot treating clumps using the herbicide ***Roundup PROMAX®*** in a 1.5 % solution with water applying this solution with a handgun or pump-up sprayer.

Another method would be to use a ***Rotowiper®*** application system with a 25 % ***Roundup PROMAX®*** solution in water.

15.1.10 Roundup PROMAX® for Control of Wildoats or Jointed Goatgrass

Control of Wildoats and Jointed Goatgrass on rights-of-way adjacent to wheat fields is best accomplished by using ***Roundup PROMAX®*** at the rate of 10 ounces per acre, and applied in the early spring. ***Roundup PROMAX®*** must be applied before the warm-season perennial grasses have begun to actively grow and broken their winter dormancy.

It is recommended that a program for control of Wildoats and Jointed Goatgrass be undertaken only where the adjacent landowner has expressed a need for control, and is trying to control the species within his crops as well.

15.1.11 Roundup PROMAX® for Complete Control in Riprap, Raised Medians, Paved Medians and Retaining Walls

The recommended application rate for vegetation growing on Riprap, Paved Medians, Raised Medians and Retaining Walls is 3 quarts of ***Roundup PROMAX®*** per acre rate using the overspray method or a 1.5 % solution of ***Roundup PROMAX®*** using the Handgun method.

15.2 General Characteristics of Landmark® XP

Landmark® XP herbicide is a residual, broad-spectrum bareground herbicide for control of broadleaf weeds and grasses. ***Landmark® XP*** is a combination of two sulfonylurea herbicides, ***Oust®*** and ***Telar®*** and this residual combination controls broadleaf weeds better than ***Oust® XP*** alone. ***Landmark® XP*** is formulated as an extruded pellet (small, cylindrical granules) which eliminates most of the excessive dust created when mixing conventional powders.

Vigorous agitation is REQUIRED when mixing ***Landmark® XP***. Therefore ***Landmark® XP*** must be used only within equipment which provides proper agitation.

Applications to the edge of pavement will be restricted to no more than 6 inches from the edge of the paved surface and 12 inches behind the guardrail. Applications wider than 12 inches may result in erosion and sediment loss.

The following precautions should always be observed when using ***Landmark® XP***:

PRECAUTION	Remark
Insure proper agitation.	
Leave buffer zone between agricultural crops, especially sorghum species.	Helps catch any spray drift and helps "tie-up" ***Landmark® XP,*** which may otherwise move laterally from treated area.
Avoid treating edges adjacent to fields in which rows run perpendicular to the highway.	If lateral movement of ***Landmark® XP*** was to occur, rows, which run perpendicular to the highway, are more likely to be affected.
Do not spray desirable vegetation.	Fruit trees are particularly susceptible to ***Landmark® XP***.

The recommended application rate for vegetation growing at the edge of pavement is 3 quarts of ***Roundup PROMAX®*** plus ***Landmark® XP*** at 2 ounces per acre rate to provide for short term control of edges and 3 ounces of ***Landmark® XP*** for extended control of vegetation in Edge of Pavement.

Landmark® XP is **NEVER** used by itself in TxDOT's herbicide spray program. This product is **ALWAYS** used in combination with ***Roundup PROMAX®*** to be applied on edge of pavement.

15.3 General Characteristics of Outrider®

Outrider® is a foliar applied herbicide with short soil residual half-life activity. The half-life (the time required for one-half of the chemical to lose its effectiveness) is approximately 16-32 days. ***Outrider***® is formulated as a dispersible granule that eliminates most of the excessive dust created when mixing conventional powders.

Vigorous agitation is REQUIRED when mixing ***Outrider***®. Therefore ***Outrider***® must be used only within equipment which provides proper agitation.

The following precautions should always be observed when using ***Outrider***®:

PRECAUTION	Remark
Insure proper agitation.	
Leave a buffer zone between agricultural crops, especially sorghum species.	Helps catch any spray drift and helps "tie-up" ***Outrider***® in the soil, which may otherwise move laterally from treated area.
Avoid treating close to fields in which rows run perpendicular to the highway.	If lateral movement of ***Outrider***® was to occur, rows, which run perpendicular to the highway, are more likely to be affected.
Do not spray desirable vegetation.	

15.3.1 Overspray Operations.

15.3.1.1 Use of Roundup PROMAX® + Outrider® Combination for Johnsongrass Control

The ***Roundup PROMAX®*** + ***Outrider***® combination is recommended for Johnsongrass control for the southern and eastern part of Texas where Bahiagrass is the predominate grass species on the right-of-way. This combination is also recommended for Johnsongrass control **when applications are made after July 31st in all areas due to wildflowers.**

However, applications of ***Roundup PROMAX®*** + ***Outrider***® should be **discontinued October 15th** because it could cause wildflower damage.

The recommended herbicides to control Johnsongrass and broadleaf weeds are ***Roundup PROMAX® + Outrider® + Vista® XRT.*** Application rates are ***Roundup PROMAX®*** at 8 ounces plus ***Outrider***® at 1.33 ounces plus ***Vista® XRT*** at 6 ounces per acre.

If adjustments are needed in recommended application rates to accommodate changing vegetation control needs, consult with the Vegetation Management Staff of the Maintenance Division.

15.3.1.2 Use of Roundup PROMAX® + Escort® XP + Outrider® for Johnsongrass Control

Use of ***Roundup PROMAX® + Escort® XP + Outrider®*** combination in an overspray application is used primarily for the control of Johnsongrass and broadleaf weed species. In the central and western parts of Texas precautions should be taken in those areas, which have prolific wildflowers.

Overspray operations should begin in the spring after Bermudagrass has broken its winter-dormancy and is actively growing, and after wildflowers have produced mature seed. Usage of the ***Roundup PROMAX® + Escort® XP+ Outrider®*** should be **DISCONTINUED BY JULY 31st**. Applications made after this date have the potential to damage fall germinating wildflowers.

The recommended herbicides to control Johnsongrass and broadleaf weeds, especially bloodweed, ragweed and sunflower are ***Roundup PROMAX® + Escort® XP + Outrider® + Vista® XRT***. Application rates are ***Roundup PROMAX®*** at 8 ounces plus ***Escort® XP*** at 1 ounce plus ***Outrider®*** at 1.33 ounces plus ***Vista® XRT*** at 6 ounces per acre.

15.3.2 Fixture Operations

15.3.2.1 Application with the Fixture Boom on All Herbicide Units

It is difficult to determine a single mixture ratio, which would satisfy the need of all spray units since there is a wide variation in output from one unit to the next. Therefore, to determine the proper mixing ratios, follow the calibration procedure below:

Step	Action	Remarks
1.	Collect spray emitted from the two outside nozzles (2508 & 6508) and the edge nozzle (6508).	Use a suitable container. Add and mix suitable drift control agent. Collect the spray from each nozzle for a period of 60 seconds.
2.	Adjust spray patterns to insure adequate and uniform coverage.	Spray pattern on the pavement to check for any gaps.
3.	Measure spray width of nozzles collectively and determine actual gallons per acre sprayed.	Use calibration formula.
4.	Find average gallons per acre (GPA)	Use average GPA as the volume of water in which to add the desired rate of ***Roundup PROMAX®*** + ***Escort® XP*** + ***Outrider®*** per acre. Fixture operations rate = 8 ounces ***Roundup PROMAX®*** plus 1 ounces ***Escort® XP*** plus 1.33 ounces ***Outrider®*** per acre.
5.	Mix appropriate amount of chemical	
6.	Add appropriate amount of drift control agent.	See Section 7

15.4 Approved Aquatic Herbicide

Dow AgroSciences™

Rodeo®

Herbicide

There is a need for controlling unwanted aquatic vegetation in ditches, drainage areas near creeks and rivers and irrigated farmlands to insure proper drainage. The use of herbicides in these areas has been limited by the possible pollution of the water and the possibility of the herbicide moving off target.

All ***Approved Aquatic Herbicides*** will be compatible with the Department's desire to be environmentally sensitive and to maintain proper drainage on and through the highway system.

15.4.1 General Characteristics of Approved Aquatic Herbicide

All of the ***Approved Aquatic Herbicides*** stocked in the warehouses will contain the active ingredient Glyphosate, at 54% concentration, the same as that found in ***Roundup PROMAX®,*** but at a higher concentration. There is no surfactant found in the ***Approved Aquatic Herbicide,*** so ***a surfactant approved for aquatic applications must be added***. All ***Approved Aquatic Herbicides*** will be labeled for use in all bodies of fresh water and in all types of aquatic sites which may contain flowing and non-flowing water. All of the ***Approved Aquatic Herbicides*** will effectively control a wide variety of emerged (above water) aquatic weeds, and it exhibits the same toxicological and environmental benefits found in ***Roundup PROMAX®***.

15.4.2 Application Procedures for Approved Aquatic Herbicide

An aquatic surfactant must be added to *Approved Aquatic Herbicide.* The mixture rate is 2-quarts of surfactant per 100-gallons of water.

Applications of ***Approved Aquatic Herbicide*** can be done with all types of spray equipment, but a handgun application may be the most desirable since many areas are inaccessible to our spray units. When applying ***Approved Aquatic Herbicide*** with a handgun mix ***a 2 % or 8 quarts of Approved Aquatic Herbicide in 100 gallons of water.*** Application should be made on a "spray-to-wet" basis for uniform and complete coverage.

Although ***Approved Aquatic Herbicide*** is primarily for use in aquatic areas such as creeks and drainage ditches, it may happen that some ***Approved Aquatic Herbicide*** mixture may be left over after completing the spraying of the aquatic weeds. In this case the leftover ***Approved Aquatic***

Herbicide mixture may be used for terrestrial (i.e. dry land) weed control in the right of way. This concentration of ***Approved Aquatic Herbicide*** will provide complete vegetation control.

15.4.3 Application Timing for Approved Aquatic Herbicide

Proper timing is important to achieve the best results. ***Approved Aquatic Herbicide*** is like ***Roundup PROMAX®*** in that it is most effective when applied late in the growing season to actively growing vegetation. Cattails should be sprayed when most plants are flowering, and willows should be sprayed when the plant has mature foliage in **late summer or fall**. The optimum treatment period for Georgia Cane or Giant Reed should be from September through October.

15.5 Escort® XP

15.5.1 General Characteristics of Escort® XP

Escort® XP is a foliar herbicide, which has a relatively short soil residual half-life. The residual effects of ***Escort® XP*** generally last for 3-4 weeks depending on soil type, rainfall, and temperature. ***Escort® XP*** is used for **selective broadleaf control** in the right of way. ***Escort® XP*** only affects Bahiagrass and will not damage other native grasses. ***Escort® XP*** is formulated as an extruded pellet (small, cylindrical granules) which eliminates most of the excessive dust created when mixing conventional powders.

Vigorous agitation is required when mixing Escort® XP. Therefore, ***Escort® XP*** must be used only within equipment, which provides proper agitation.
Follow these precautions which using the herbicide ***Escort® XP***:

PRECAUTION	REMARK
Insure proper agitation	Necessary to prevent chemical from settling in tank
Leave buffer zone between agricultural crops.	Helps catch any spray drift and helps "tie-up" ***Escort® XP,*** which may otherwise move laterally from treated area.
Avoid treating adjacent to fields in which rows run perpendicular to the highway.	If lateral movement of ***Escort® XP*** was to occur, rows, which run perpendicular to the highway, are more likely to be affected.
Do not spray desirable vegetation.	Fruit trees are particularly susceptible to ***Escort® XP.***
Always read and follow label instructions for proper application and to determine plants which are susceptible to Escort® XP.	

15.5.2 Application Procedures with Escort® *XP*

A surfactant must be added to any *Escort® XP* application at a rate of 1 quart per 100 gallons of water.

Application of ***Escort® XP*** can be made with all of the overspray equipment now being used in the Department of Transportation. ***Escort® XP*** and the ***Approved Aquatic Herbicide*** both need the addition of a surfactant in the mixture. Without the addition of a surfactant results will be tremendously reduced. Apply ***Escort® XP*** using the following table:

SPECIES OF PLANTS	RATE	TIME OF YEAR
Field Bindweed	1 ounce per acre	June -September
Common Sunflower	1 ounce per acre	Spray when 2-3 feet in height.
Western Bitterweed	1 ounce per acre	March - April
Turnip Weed	1 ounce per acre	very early Spring
Morning Glory Vine	1 ounce per acre	June -September
African Rue	3 ounces per acre	September
Other Broadleaf Weeds	1 ounces per acre	May - July 31st

***Escort® XP* is primarily used for control of specific noxious weeds. Consult the Vegetation Management Staff in the Maintenance Division for further uses of this product.**

15.5.3 Use of Escort® XP with combination of Roundup PROMAX® + Outrider® for Johnsongrass and Broadleaf Weed Control

Escort® XP will be used in conjunction with ***Roundup PROMAX® + Outrider®*** in an overspray application used primarily for the control of Johnsongrass and broadleaf weed species. In the central and western parts of Texas precautions should be taken in those areas, which have prolific wildflowers. ***Escort® XP*** only affects Bahiagrass and will not damage other native grasses.

Overspray operations should begin in the spring after Bermudagrass has broken its winter-dormancy and is actively growing, and after wildflowers have produced mature seed. Usage of the ***Roundup PROMAX® + Escort® XP+ Outrider®*** should be **DISCONTINUED BY JULY 31st**. Applications made after this date have the potential to damage fall germinating wildflowers.

15.6 Transline®

15.6.1 General Characteristics of Transline®

Transline® is an herbicide used effectively to kill certain broadleaf vegetation in the right of way. ***Transline***® is a **selective, post-emergent herbicide that controls certain broadleaf weeds** and does not have any activity on grasses. ***Transline***® has a short soil residual half-life of approximately 23 days. It is non-volatile and relatively low in toxicity to animals. However, care must be taken to prevent the drift of spray particles and to prevent accidental foliar application to desirable plants.

15.6.2 Application Procedures for Transline® on Musk Thistle

Musk Thistle is a biennial weed, which can cause serious safety and agricultural problems. It ranges throughout central Texas into the panhandle.

Control of Musk Thistle can be easily accomplished by using ***Transline***® at the proper time. An application of ***Transline***® at 10 ounces per acre applied early spring will provide effective control of Musk Thistle. The Musk Thistle should be actively growing and the application should be made prior to seed set on the plants.

15.6.3 Application Procedures for Transline® on Common Sunflower

Common Sunflowers are annual broadleaf weeds, which may reach a height of 8-10 feet. Sunflowers are common throughout the state, but usually occur in disturbed areas and cause a serious safety and drainage problem in the southern half of the state.

Sunflowers may be controlled with an application of ***Transline***® at 10 ounces per acre, applied in late spring through early summer. Plants should be sprayed when they are 1-3 feet in height.

DO NOT SPRAY MATURE PLANTS. This will yield poor results.

15.6.4 Application Procedures for Transline® on Mesquite

Mesquite grows either as a shrub or a tree and is abundantly armed with stiff spines. The plants usually flower in the spring, but sometimes later. The flowers are very small and grouped together in conspicuous yellowish bunches. Mesquite is widely distributed in the western half and southern Texas, generally in deep soils. It increases in abundance in disturbed grasslands.

Mesquite, where it occurs in areas of the right of way, which must be maintained, may be mowed annually at the time of the fall full-width mowing. Alternatively, where the plants are large enough or the need of removal is necessary, with the herbicide ***Transline***®, at 21 ounces per acre plus surfactant at the rate of ½%, applied in mid-summer through early fall.

15.6.5 Application Procedures for Transline® on Huisache

Huisache is a brushy species, which occurs as both shrubs and trees, usually with several trunks. The branches are numerous and armed with many paired, pin-like, pale spines. The fragrant yellow flowers are clustered in small spheres. The plants flower in the spring, but many produce flowers again after rain during periods of drought.

Huisache is primarily found in South Texas, extending north to Travis County and northwest to Brewster County.

Huisache can be controlled with the herbicide ***Transline***®, at 21 ounces per acre plus surfactant at the rate of ½%, applied in mid-summer through early fall.

15.6.6 Application Procedures for Transline® on Retama

Retama is widely branching small tree with sharp, slightly curved spines on green barked branches. The flowers are yellow, and are identifiable as distinct, individual flowers. The plant may flower Spring through fall, depending on location and climate.

Retama can be controlled with the herbicide ***Transline***® at 21 ounces per acre plus surfactant, at the rate of ½ %, applied in mid-summer to early fall.

15.6.7 Application Procedures for Transline® on Kudzu

Kudzu is a perennial, trailing or climbing vine of the legume family with a very aggressive behavior. Dark green leaves and rarely blooming purple elongated flowers that have a fragrance reminiscent of grapes. Kudzu is nicknamed “The Vine that Ate the South” for its aggressive covering and choking out of small trees and under story vegetation.

Range consists of small pockets in the eastern part of Texas with one infestation being eradicated by the Colorado River in south Austin.

Kudzu can be controlled with the herbicide ***Transline***®, at 21 ounces per acre plus surfactant at the rate of ½%, applied during the growing season. One application will not eradicate this aggressive vine and retreatments of ***Transline***® along with Basal Bark and cut stump treatments will need to be scheduled into an ongoing program to eliminate this plant. Seed are viable for several years after dropping and pose a threat downstream of re-infestation of this noxious weed.

Note: The herbicide ***Transline***® at 21 ounces per acre is the maximum rate per spraying season.

15.6.8 Low Volume Foliar Spray for Transline® on Mesquite and Huisache

Mesquite and Huisache are brushy species and a full description is stated above.

Low volume foliar spray can be accomplished using a X6 tip on a 25-gallon Poly Tank sprayer with 12-volt electric pump. Mesquite and Huisache can be controlled with the herbicide ***Transline®,*** at a rate of ½% plus surfactant at the rate of ½%, applied in mid-summer through fall. *Do not exceed 21 oz/acre labeled rate of Transline® per spraying season.*

The four-wheel utility vehicle can be rigged to carry two 25-gallon tanks in the back to do a low-volume foliar application. Applicators don't have to leave the vehicle to make these applications in most situations.

15.6.9 Effects of Transline® Applications During Dry Weather

High temperatures, prolonged periods of dry weather and lack of soil moisture tend to force plants into a semi-dormant state. When these conditions exist, plants tend to slow down their growth in order to conserve moisture and energy. With this conservation of moisture and energy, the plant will not absorb an adequate amount of the herbicide and all spraying should cease at this time.

15.6.10 Precautions using Transline®

Do not make ***Transline®*** applications if rainfall is imminent. ***Transline®*** becomes rainfast in 1-2 hours.

Transline® does not volatilize (i.e. does not form a gas). It can be used safely in all areas except aquatic areas. However, care must be taken to prevent drift onto the foliage of desirable plants. Drift usually occurs when the operating pressure is too high for the nozzle tips being used, or when spraying in windy conditions. To aid in drift control always use the appropriate drift control agent (see Section 7).

Care must be taken while spraying ***Transline®*** in wildflower areas.

15.7 Pathfinder II®

15.7.1 General Characteristics of Pathfinder II®

For many years there has been a need for controlling brush in the right of way. The brush on the right of way has proven to be difficult to control due to the continuous mowing, removing the tops of the brush species while still allowing root systems to grow. Many herbicides have proven to be ineffective on this mowed brush. ***Pathfinder II***® has proven to be very effective on this type of brush.

Pathfinder II® is a ready-to-use herbicide mixture, which has Triclopyr as the active ingredient. It has a basal oil carrier that reduces environmental hazards by penetrating the brush species bark while carrying the active ingredient with it.

15.7.2 Application Procedures for Pathfinder II®

Applications of ***Pathfinder II***® are limited to basal bark treatments from either backpack sprayers or small electric spray units. The basal bark treatment is a low volume treatment and the correct nozzle on the handgun is essential. The spray nozzle should be **Spray Systems Cone Jet Adjustable #5500-X1 or X2.** This allows the correct amount of herbicide to be dispensed. **All backpacks and spray units should have Viton® gaskets to prevent leakage.**

Your district Vegetation Manager has a videotape, which fully explains the product and recommended application techniques.

Using the wrong nozzle tip with *Pathfinder II*® will result in cost/acre increasing dramatically.

When applying ***Pathfinder II***® the lower 12-15 inches of the bark should be sprayed. Complete coverage around the bark is essential for complete control of the brush species. Bark should be wet, but not to the point of runoff.

Complete coverage of the bark is necessary. If coverage is not achieved resprouting will occur.

15.8 Vista® XRT

Applications to mature plants usually result in poor control.

15.8.1 General Characteristics of *Vista® XRT*

Vista® XRT is a selective postemergent product for control of annual and perennial broadleaf weeds. A dark brown liquid, non-volatile and rainfast in one hour after application. Is highly effective for the postemergent control of Giant Ragweed (Bloodweed), Kochia, the resistant/tolerate biotypes of Kochia and Russian Thistle.

15.8.2 Precautions using *Vista® XRT*

Kochia and Russian Thistles are annual weeds, which can cause serious safety and agricultural problems. It ranges throughout the western region of Texas.

Control of Kochia can be easily accomplished by using ***Vista® XRT*** at the proper time. An application of ***Vista® XRT*** at 6 ounces per acre applied in late spring through summer will provide effective control. Kochia should be actively growing and the application should be made prior to seed set on the plant. ***Vista® XRT*** can be applied with either the handgun or overspray application method.

Control of Russian Thistle can be easily accomplished by using ***Vista® XRT*** and ***Escort® XP*** at the proper time. An application of ***Vista® XRT*** at 6 ounces per acre and ***Escort® XP*** at 1 oz per acre applied in late spring through summer will provide effective control. Russian Thistle should be actively growing and the application should be made prior to seed set on the plant. Application **c**an be made with either the handgun or overspray application method.

Do not apply more than 22 ounces or 1 1/3 pints per acre of ***Vista® XRT*** annually.

15.8.3 Application Procedures for *Vista® XRT* on Giant Ragweed (Bloodweed)

Giant Ragweed (Bloodweed) is an annual weed, which can cause serious safety and drainage problems in the state. It can obtain heights up to 15 feet tall.

Vista® XRT can be utilized as a lower costing alternative to ***Transline®*** for controlling Giant Ragweed (Bloodweed) when applied in late spring and early summer. Apply ***Vista® XRT*** at 6 ounces per acre plus the addition of an approved surfactant at the rate of 2 quarts per 100 gallons of water in a broadcast application or 6 ounces of ***Vista® XRT*** plus 2 quarts of surfactant per 100 gallons of water with a handgun sprayer when the Giant Ragweed is 1-3 feet tall and actively growing. Early applications result in the most effective control and allow desirable vegetation to be established in the sprayed area. Always add surfactant at the rate of 2 quarts per 100 gallons of water.

15.10 Milestone® VM Plus

15.10.1 General Characteristics of *Milestone® VM Plus*

Milestone® VM Plus herbicide controls broadleaf weeds, including invasive and noxious weeds on non-cropland areas including right-of-ways and around these sites without injury to most grasses.

Milestone® VM Plus will also chemically prune woody plants and tree limbs encroaching in the clear zone on the state's right-of-ways. With the flex-5 spray head woody plants can be controlled with the herbicide ***Milestone® VM Plus***, at 6 pints per acre plus surfactant at the rate of ½%. ***Milestone® VM Plus*** can be applied at anytime during the growing season when the woody plants are actively growing with adequate foliage.

The addition of 6 ounces per acre of ***Vista® XRT*** can be added to 6 pints per acre of ***Milestone® VM Plus*** for the control of Hackberries and strong underbrush plus surfactant at the rate of ½%.

Note: The herbicide ***Milestone® VM Plus*** at 9 pints per acre is the maximum rate per year.

Chemical Pruning in Comanche County using Milestone® VM Plus.

SECTION 16

16.0 OTHER HELPFUL INFORMATION

- **Herbicide License and Operator Responsibilities**
- **Area Coverage at Different Speeds Chart**
- **Quick Rate Chart for Percentage Solutions**
- **Standard Rate Conversions**
- **(New) Calibrating the Calc-an-Acre II**
- **(Old) Calibrating the Calc-an-Acre $_{LR}$**
- **(Old) Digital Speed Indicator Calibration Chart - With "MPH/Distance Key"**
- **(Old) Digital Speed Indicator Calibration Chart - Without "MPH/Distance Key"**
- **Drift Minimization and Surfactant Recommendations**
- **Handgun/Backpack Calibration**
- **Fixture Boom Schematic**
- **How to Calibrate a Fixture Boom**
- **Timing of Herbicide Operations**
- **Quick Reference Table**
- **Herbicide Half-Life and Wait to Spray Times**
- **DHT Numbers for Selected Herbicide Truck Components**
- **Useful Conversion Factors**

HERBICIDE LICENSES & OPERATOR RESPONSIBILITIES

Through an agreement with the Texas Department of Agriculture (TDA), TxDOT personnel are issued a "Noncommercial Political Pesticide Applicators License" after receiving training and passing a 3-part exam given by personnel within the Maintenance Division (MNT).

Once you are licensed, **it is your individual responsibility to insure that your license remains current.**

LICENSE YEAR:

Your license is effective for a 12 month period which **starts from the date of issue**.

In order to maintain your license, **you must meet TDA's annual CEU** (continuing education units) **requirements.**

SELF-CERTIFICATION:

Personnel within the Vegetation Management Staff of MNT provide annual training seminars, which will satisfy TDA's current CEU requirements.

These training sessions are provided by MNT between January and April of each year, and held at each district office. MNT personnel send an annual report to TDA with the names of each employee who attended the training, and who sat for examination.

THE YEAR YOU PASS THE TEST:

After you receive your license it is necessary to obtain additional training within the year after testing for the required CEU's to maintain your TDA license. This is normally done by viewing the **videotapes or DVD**, which are available through each district Vegetation Manager. These videos are normally shown during the fall of each year. Contact your Vegetation Manager to arrange for viewing the tapes.

EACH YEAR THEREAFTER:

As long as you remain in TxDOT's program, you **must attend one of the training sessions offered by TxDOT or watch the videotapes** available through your Vegetation Manager.

Furthermore, and probably most importantly, **you must sign and return the Application for Renewal form directly to the TDA**. If you do not receive your renewal form from TDA, you must contact TDA as soon as possible.

If you attend TxDOT training, but fail to return TDA's Application for Renewal Form, your license will be canceled by TDA, and you will be required to retest in order to remain within TxDOT's program.

WHO YA GONNA' CALL?

If you are having licensing difficulties, or have questions about your Noncommercial Political Pesticide Applicators License, contact:
1) Your district Vegetation Manager; or
2) MNT at (512) 416-3093; or
3) TDA at 1-800-835-5832.

AREA COVERAGE AT DIFFERENT SPEEDS

Approximate ACRES Sprayed in One Hour			
Spray Width in Inches (Feet)	**Speed of Application (Miles per Hour)**		
	5 MPH	**10 MPH**	**11.36 MPH**
12" (1)	**0.6**	**1.2**	**1.4**
24" (2)	**1.2**	**2.4**	**2.8**
36" (3)	**1.8**	**3.6**	**4.1**
48" (4)	**2.4**	**4.8**	**5.5**
60" (5)	**3.0**	**6.0**	**6.9**
72" (6)	**3.6**	**7.2**	**8.3**
84" (7)	**4.2**	**8.4**	**9.6**
96" (8)	**4.8**	**9.6**	**11.0**
108" (9)	**5.5**	**11.0**	**12.4**
120" (10)	**6.1**	**12.2**	**13.8**
180" (15)	**9.1**	**18.2**	**20.7**
240" (20)	**12.1**	**24.2**	**27.5**
300" (25)	**15.2**	**30.4**	**34.4**
360" (30)	**18.2**	**36.4**	**41.3**
420" (35)	**21.2**	**42.4**	**48.2**

QUICK RATE CHARTS FOR PERCENTAGE (%) SOLUTIONS

Add the Following Ounces of Herbicide to Get…							
With This Volume of Water	**¼ of 1%**	**½ of 1%**	**1%**	**1½%**	**2%**	**2½%**	**3%**
1 Gal (128 Oz)	**0.3**	**0.6**	**1.3**	**1.9**	**2.6**	**3.2**	**3.8**
2 Gal (256 Oz)	**0.6**	**1.3**	**2.6**	**3.8**	**5.1**	**6.4**	**7.5**
3 Gal (384 Oz)	**1**	**1.9**	**3.8**	**5.8**	**7.7**	**9.6**	**11.5**
4 Gal (512 Oz)	**1.3**	**2.6**	**5.1**	**7.7**	**10.2**	**12.8**	**15.4**
5 Gal (640 Oz)	**1.6**	**3.2**	**6.4**	**9.6**	**12.8**	**16 (1 Pint)**	**19.2**
10 Gal (1,280 Oz)	**3.2**	**6.4**	**12.8**	**19.2**	**25.6**	**32 (1 Quart)**	**96 (3 Quarts)**
25 Gal (3,200 Oz)	**8 (½ Pint)**	**16 (1 Pint)**	**32 (1 Quart)**	**48 (1½ Quarts)**	**64 (2 Quarts)**	**80 (2½ Quarts)**	**96 (3 Quarts)**
50 Gal (6,400 Oz)	**16 (1 Pint)**	**32 (1 Quart)**	**64 (2 Quarts)**	**96 (3 Quarts)**	**128 (4 Quarts)**	**160 (5 Quarts)**	**192 (6 Quarts)**
100 Gal (12,800 Oz)	**32 (1 Quart)**	**64 (2 Quarts)**	**128 (4 Quarts)**	**196 (6 Quarts)**	**256 (8 Quarts)**	**320 (10 Quarts)**	**384 (12 Quarts)**

STANDARD RATE CONVERSION

1 Ounce (mass) per Acre =	**70 Grams per Hectare (g/ha)**
2 Ounces (mass) per Acre =	**140 g/ha**
3 Ounces (mass) per Acre =	**210 g/ha**
½ Quart per Acre =	**1.2 Liters per Hectare (L/ha)**
½ Quart plus 2 Ounce =	**1.2 Liters plus 140 g/ha**
1 Quart per Acre =	**2.3 L/ha**
3 Quarts per Acre =	**7 L/ha**
4 Quarts per Acre =	**9.3 L/ha**
5 Quarts per Acre =	**11.5 L/ha**
8 Ounces per 100 Gal Water =	**250 Milliliters per 400 Liters**
10 Ounces per 100 Gal Water =	**312 Milliliters per 400 Liters**
10 Ounces (fluid) per Acre =	**730 Milliliters per Hectare (mL/ha)**
1 Quart per 100 Gal Water =	**1 Liter per 400 Liters**
2 Quarts per 100 Gal Water =	**2 Liters per 400 Liters**
8 Quarts per 100 Gal Water =	**8 Liters per 400 Liters**
25 psi (Check Valves) =	**172 Kilopascals (kPa)**
30 psi (Spray Pressure) =	**207 kPa**
35 psi (Spray Pressure) =	**241 kPa**
1 Gallon = 128 Fluid Ounces =	**3.78 Liters**
25 Gallons per Acre (GPA) =	**234 L/ha**
5 Miles per Hour (MPH) =	**8 Kilometers per Hour (km/h)**
11.36 Miles per Hour (MPH) =	**18 km/h**

Calibrating the CALC-AN-ACRE® II

1. With power off - select "**Area**", press "**CAL/RESET**" and turn vehicle on.
2. Then put in "**HOLD**" mode and press "**CAL**" until the word CAL shows up on display.
3. Press "**CAL**" again until not displaying.
4. Put in "**HOLD**" mode and turn knob to "**Distance**" and be sure display shows **"0".**
5. If not, press **"RESET"** until display shows **"0"** and the word **"CLEAr"** will also be displayed when reset is pressed prior to showing **"0"**.
6. Before driving **"500 feet"** use the **"RUN/HOLD"** button to start and stop the counting function.
7. Press **"RUN"** when passing the starting flag to activate the distance counting function.
8. Travel **500 feet** and at the end of **500 feet** press the "**HOLD"** button.
9. Press and hold the **"CAL"** button for one second.
10. Press **"CAL"** again and the word **"CAL**" will begin to flash and distance traveled will be displayed.
11. When **"CAL"** is flashing verify whether the number displayed is the exact distance **(500 feet)** that you drove. If not, press the **"+" or "-"** key to adjust the figure to **"500" (or as close as possible to 500)**, which will match the distance you actually drove.
12. Read the new circumference number "**_____**" and record it.
13. Then select **"Speed"** on dial and check speed against speedometer.

CALC-AN-ACRE® II

Control Head & Digital Speed Indicator

Truck application speed should always be read from the Digital Speed Indicator

The cab-mounted control head powers up to 6 nozzle banks and raises the Flex-5 boom up and down

(Old) Calibrating the CALC-AN-ACRE® LR

1. With power off - select **"total area",** press **"cal/reset"** and turn vehicle on.
2. Select **"sub area / width"** and put in **"hold"** mode.
3. Press **"cal"** for three seconds.
4. Set width on **99**.
5. Press **"cal"** for 3 seconds and set in **"run mode"**.
6. Turn knob to **"distance"** and put in **"hold"** mode.
7. Press **"cal"** for 3 seconds - (screen should flash).
8. Set **circumference** on **5.0** and put in **"run mode"**.
9. Press **"cal"** for 3 seconds.
10. Press reset button and put in **"hold"** mode.
11. Press **"cal"** for 3 seconds and put in **"run"** mode.
12. Travel 500 feet.
13. Put in **"hold"** mode, and **"+ or -"** to 500 feet.
14. Press **"cal"** for 3 seconds.
15. Put in **"run"** mode and then put in **"hold"** mode.
16. Press **"cal"** for 3 seconds (take off calibration).
17. Read new circumference #, and press **"cal"** for 3 seconds.
18. Select speed on dial and check speed against speedometer.

(Old) CALC-AN-ACRE® LR

Entering Wheel Circumference Value

Having determined the correct wheel circumference (CIRC) value, turn ignition switch on to power up the console.

1. Place the console in HOLD.

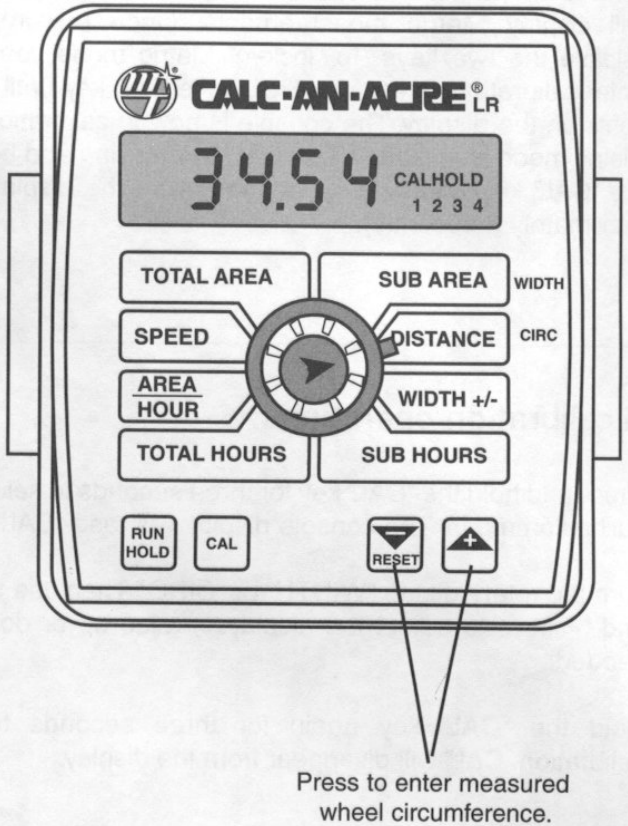
2. Press and hold the "CAL" key for three seconds to enter the calibration mode and turn the dial to "CIRC" position. The display will alternate between the wheel circumference (CIRC) and distance values at about three-second intervals. (When the words "CAL" and "HOLD" and "1 2 3 4" appear, the number displayed is the wheel circumference (CIRC) value. When only the word "HOLD" and "1 2 3 4" appear, that is the distance value.)

3. When the display shows wheel circumference ("CAL", "HOLD" and "1 2 3 4" are displayed) , use the "+" and "-" keys to adjust the displayed value to the desired number. When the number shown on the display matches the desired value, you have arrived at the starting calibration value. Exit "CAL" by pressing and holding the "CAL" key for three seconds.

NOTE: If you let go of the "+" and "-" keys while you are adjusting the CIRC value, the console will wait to make sure you are finished. After 64 seconds, the display will start alternating between the wheel circumference (CIRC) and distance values again. Make sure you know which value you are adjusting.

NOTE: For fine-tuning the wheel circumference (CIRC) value, turn to page 16.

Illustration 14



Press to enter measured wheel circumference.

Digital Speed Indicator Calibration

For Older Units "With" a *MPH/DIST* Key

STEP	ACTION
1	Clear **FIELD ACRES** by pressing and hold key for approximately 3 seconds, and then release when readout displays ***0.0.***
2	Clear **TOTAL ACRES** by pressing and holding key for approximately 3 seconds, then release when readout displays ***0.0.***
3	Press and hold **W (Width)** key and at the same time, press the ***"+ or -"*** key the change circumference readout to display ***1.0***, then release.
4	Press and hold **C (Circumference)** key and at the same time, press the ***"+ or -"*** key to change circumference readout to display 1.0, then release.
5	Press the **MPH/DIST** key to change readout to "speed" mode (readout will display ***S 0.0***), then press ***MPH/DIST*** key to change readout to display distance.
6	Clear distance by pressing and holding the **MPH/DIST** key for approximately 3 seconds, then release when readout displays ***0.0***.
7	Drive the vehicle for a distance of exactly one-mile (5,280 feet), and then safely stop the vehicle.
8	Press and hold the ***MPH/DIST*** key and at the same time, press the ***"+ or _"*** key to change the distance readout to display ***5280***, then release.
9a	If the readout displays the words ***"Help Calib",*** return to Step 4 and enter a circumference of ***5.0***; Otherwise go to step 10.
9b	Repeat steps 5 through 9.
10	Record the Circumference number on the front cover of the Herbicide Record Book.

For Older Units "With" a ***MPH/DIST*** Key (contd.)

Daily Operation Checklist	
1	Turn the unit on by pressing the ***C (Circumference)*** key.
2	Compare the number shown on the digital display to the number recorded for Circumference on the front cover of the Herbicide Record Book.
3	If numbers are not identical, press and hold the ***C (Circumference)*** key and at the same time press the ***"+ or -"*** key and adjust the readout to the number determined in step 10 above and as shown on the front cover of the Herbicide Record Book.
4	If numbers are identical, press the ***MPH/DIST*** key to change the readout mode to speed (readout will display ***S 0.0***).
5	Proceed with normal spraying operations **USING DIGITAL SPEED INDICATOR TO MONITOR VEHICLE SPEED**.
6	If unit reads speed inaccurately or erratically, **REPORT THE MALFUNCTION TO YOUR DISTRICT VEGETATION MANAGER**.

Note: This unit is to be used for measuring the speed of the vehicle only, and should not be used to measure the number of acres sprayed.

For Older Units "Without" a ***MPH/DIST*** Key

STEP	ACTION
1	Clear **FIELD ACRES** by pressing and holding key for approximately 3 seconds, then release when readout displays ***0.0.***
2	Clear **TOTAL ACRES** by pressing and holding key for approximately 3 seconds, then release when readout displays ***0.0.***
3	Press and hold **W (Width)** key and at the same time, press the ***"+ or -"*** key the change digital readout to display ***99***, then release.
4	Press and hold **C (Circumference)** key and at the same time, press the ***"+ or -"*** key to change circumference readout to display ***5.0***, then release.
5	Clear ***TOTAL ACRES*** by pressing and holding key for approximately 3 seconds, then release when readout displays ***0.0.***
6	Drive the vehicle for a distance of exactly one-mile (5,280 feet), then safely stop (the speed sensor will likely display a value between ***0.4*** or ***0.6*** Total Acres.
7	Press and hold the ***TOTAL ACRES*** key and at the same time, press the ***"+ or _"*** key to change digital readout to display ***1.0***, then release.
8	Press and release ***C (Circumference)*** key to read Circumference.
9	If the digital display reads ***"Help Calib",*** return to Step 4 and repeat steps 4 through 8; Otherwise go to step 10.
10	Record the Circumference number on the front cover of the Herbicide Record Book.

For Older Units "Without" a ***MPH/DIST*** Key (contd.)

Daily Operation Checklist	
1	Turn the unit on by pressing the ***C (Circumference)*** key.
2	Compare the number shown on the digital display to the number recorded for Circumference on the front cover of the Herbicide Record Book.
3	If numbers are not identical, press and hold the ***C (Circumference)*** key and at the same time press the ***"+ or -"*** key and adjust the readout to the number determined in step 10 above and as shown on the front cover of the Herbicide Record Book.
4	If numbers are identical, press the ***MPH*** key to change the readout mode to speed (readout will display ***S 0.0***).
5	Proceed with normal spraying operations **USING DIGITAL SPEED INDICATOR TO MONITOR VEHICLE SPEED**.
6	If unit reads speed inaccurately or erratically, **REPORT THE MALFUNCTION TO YOUR DISTRICT VEGETATION MANAGER**.

Note: This unit is to be used for measuring the speed of the vehicle only, and should not be used to measure the number of acres sprayed.

DRIFT MINIMIZATION AND SURFACTANT RECOMMENDATIONS

DRIFT CONTROL:

Appropriate drift control should be used with all herbicides when using the truck handgun, fixture or Flex-5 booms. Drift control is not required when using backpack sprayers.

THE OPERATOR, HOWEVER, SHOULD ALWAYS INSURE THAT THE HERBICIDE IS BEING PLACED ON TARGET REGARDLESS OF THE METHOD OF APPLICATION. IF WIND CONDITIONS ARE SUCH THAT THE SPRAY CANNOT BE KEPT ON TARGET, THE OPERATOR SHOULD CEASE SPRAY OPERATIONS.

Drift control should be shaken thoroughly, then slowly injected into the system, using the integral drift control injector. ***Addition of Drift Control through the main tank lid in not recommended.***

Drift control rates are *2 fluid ounces per 100 Gallons of Water.*

SURFACTANT:

A surfactant is required when using *Approved Aquatic Herbicide, Escort® XP* and *Transline®* when spraying Mesquite and Huisache.

The surfactant rate for *Escort® XP* is 1 quart per 100 gallons of water.

The surfactant rate for *Approved Aquatic Herbicide* is 2 quarts per 100 gallons of water.

The surfactant rate for *Transline®* is 2 quarts per 100 gallons of water or ½% when spraying Mesquite and Huisache.

The surfactant rate for *Vista® XRT* is 2 quart per 100 gallons of water when spraying Giant Ragweed.

The surfactant rate for *Outrider®* is 2 quart per 100 gallons of water when spraying Johnsongrass by itself.

The surfactant rate for *Habitat®* is 2 quart per 100 gallons of water.

Handgun / Backpack Calibration

Method A:

Fill the handgun with clean water.
With a watch or stopwatch, time how long it takes to uniformly spray an area, which is 18½ feet by 18½ feet.
Using the recorded time, spray again into a measuring device. The fluid ounces collected will equal the Gallons Per Acre (GPA).

Method B:

Fill the handgun with clean water up to a specific marked level.
Uniformly spray an area, which is 18½ feet by 18½ feet.
Measure how many fluid ounces it takes to fill the sprayer back up to the marked level.
The fluid ounces sprayed out will equal the Gallons Per Acre (GPA).

If the operator does not calibrate the handgun using either of these methods, then use an estimated rate of 100 GPA.

Fixture Boom Schematic

Inside 8008 or Turbo-Drop - Sprays vegetation in shoulder

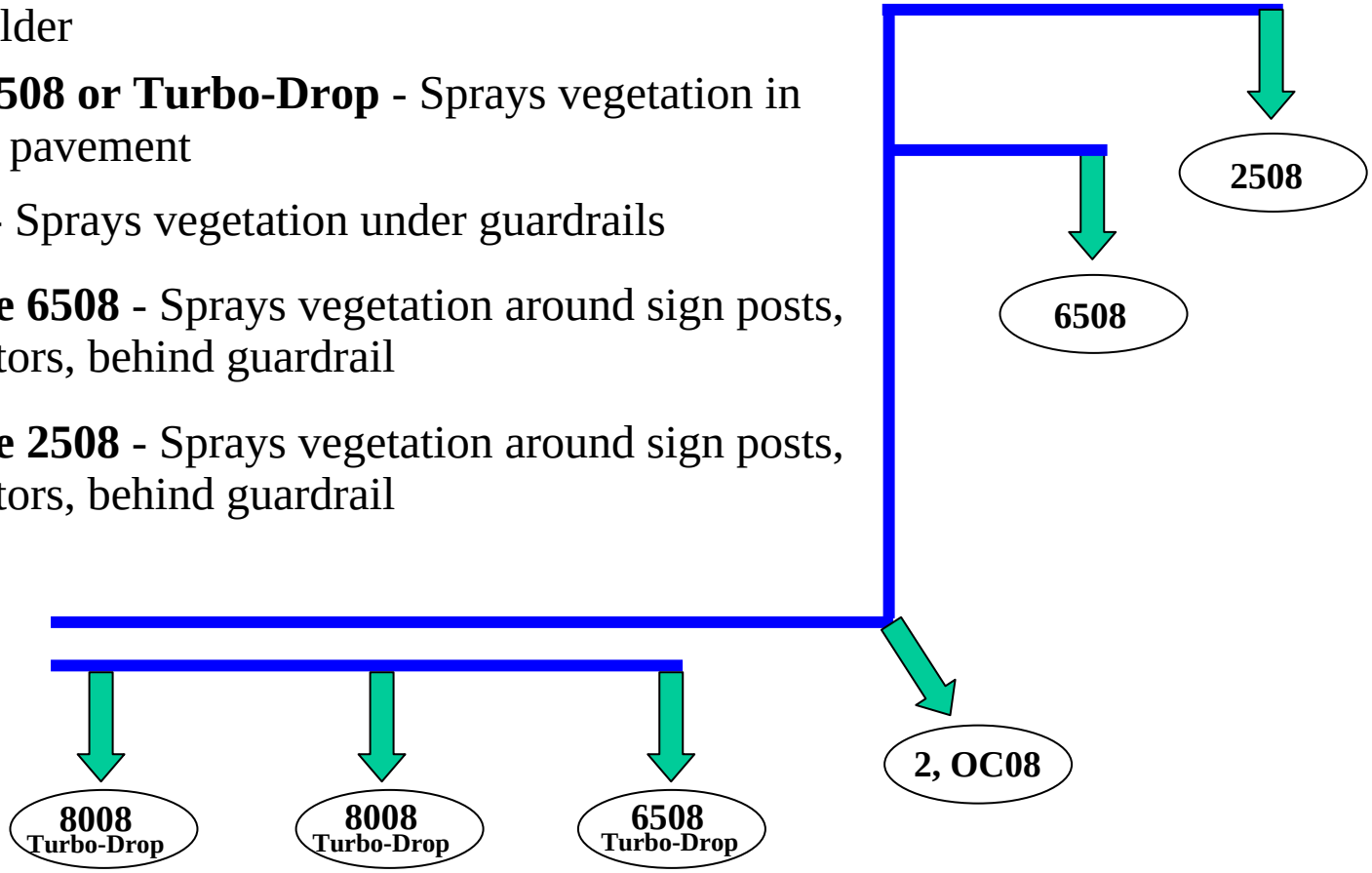
Middle 8008 or Turbo-Drop - Sprays vegetation in shoulder

Edge 6508 or Turbo-Drop - Sprays vegetation in edge of pavement

OC08 - Sprays vegetation under guardrails

Outside 6508 - Sprays vegetation around sign posts, delineators, behind guardrail

Outside 2508 - Sprays vegetation around sign posts, delineators, behind guardrail



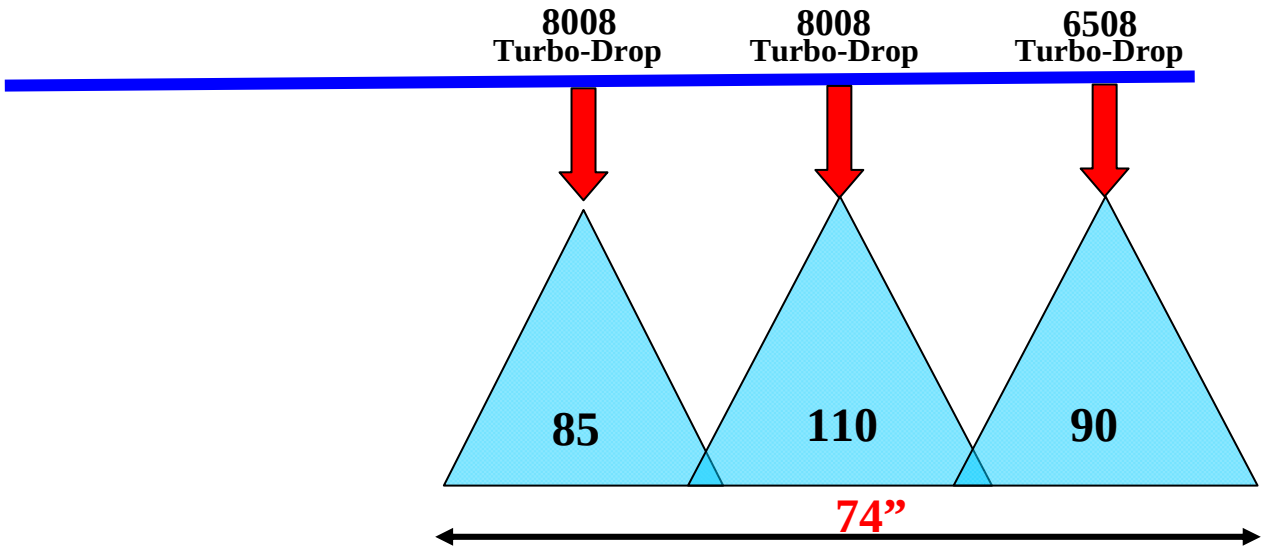
Calibrating your Fixture Boom

Step 1: Select the nozzles you know you will be using for your application

Step 2: With drift control in the main tank, collect the fluid out of each nozzle selected for a period of 60 seconds and record the volume in fluid ounces

Step 3: Record the spray width of the selected nozzles.

Step 4: Do the math.



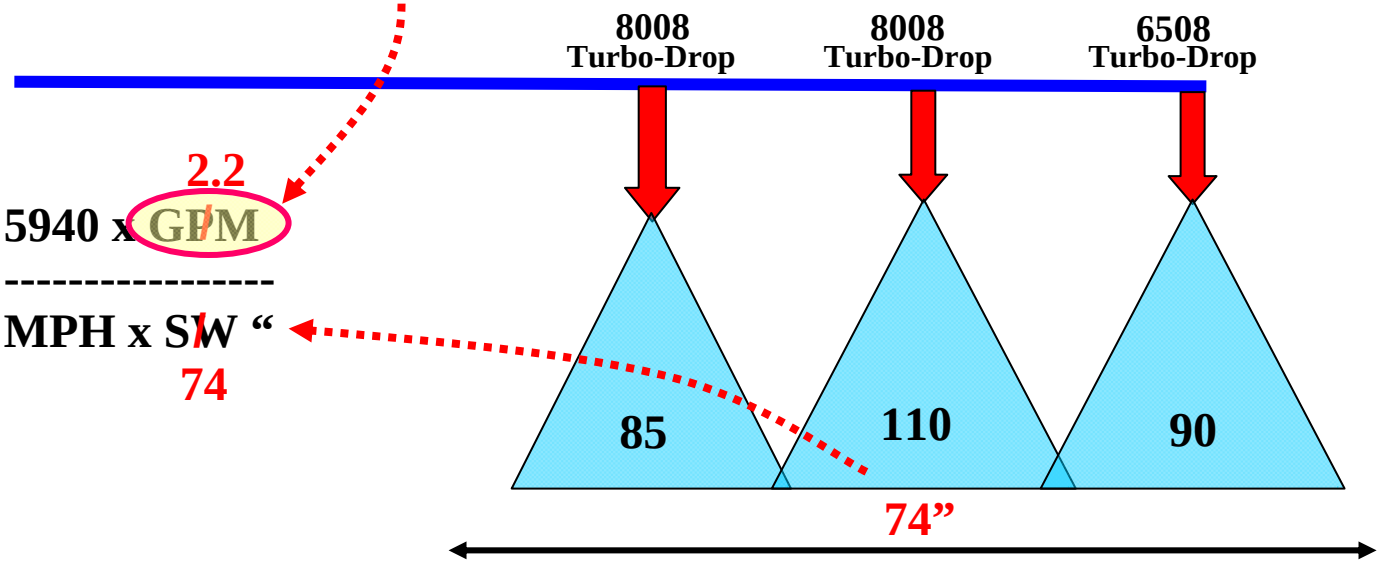
Calibrating your Fixture Boom (contd.)

85 +
110 +
90 =
---
285 Fl Oz / Minute

285 divided by 128 fl oz per gallon = 2.2 GPM

Now, plug these numbers into the Formula:

$$GPA = \frac{5940 \times 2.2 \text{ GPM}}{MPH \times SW \text{ “ } / 74}$$



Calibrating your Fixture Boom (contd.)

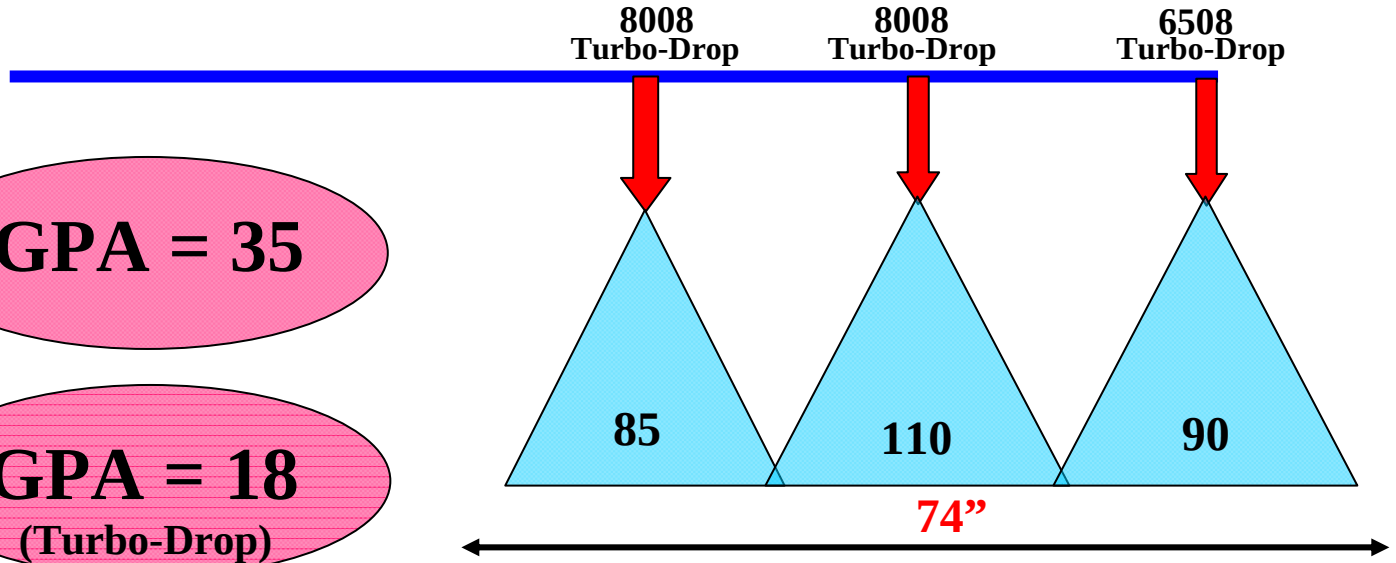
$$GPA = \frac{5940 \times GPM}{MPH \times SW \text{ “}}$$

$$\text{Regular Nozzles or Turbo-Drop: } GPA = \frac{5940 \times 2.2}{5 \text{ or } 10 \times 74}$$

$$\text{Regular Nozzles or Turbo-Drop: } GPA = \frac{13{,}068}{370 \text{ or } 740}$$

Regular Nozzles **GPA = 35**

or Turbo-Drop **GPA = 18** (Turbo-Drop)



GPA = 18
(Turbo-Drop)

Example 1: Tank mix a 300-gallon load of *Roundup PROMAX*® and *Landmark*® *XP* for complete control (bare ground) along the edge of pavement with Turbo-Drop Nozzles.

Step 1: Determine the number of acres you can spray:

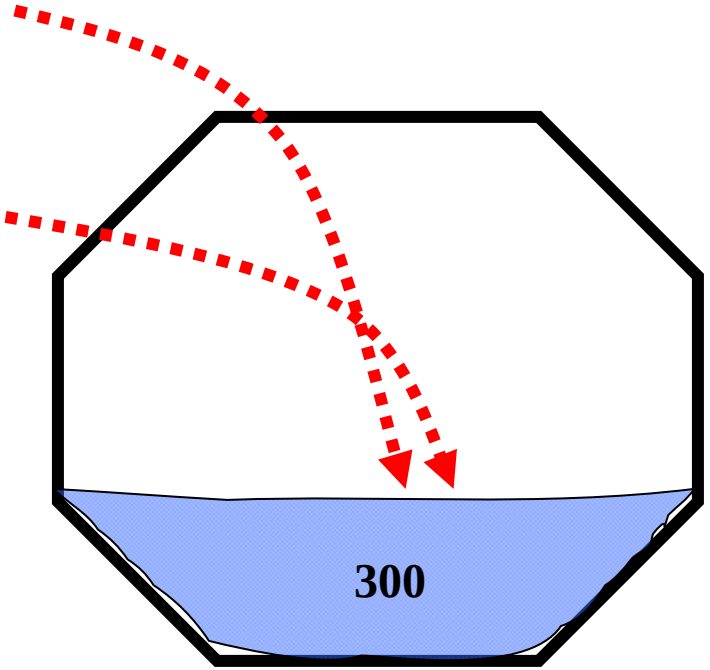
$$\frac{\text{300 gal}}{\text{18 GPA}} = \text{16.7 Ac}$$

Step 2: Determine the proper amount of *Roundup PROMAX*® and *Landmark*® *XP* to add:

16.7 Ac x 3 Qt. / Ac = 50.1 Qts.
16.7 Ac x 3 Oz. / Ac = 50.1 Ozs.

Step 3: Determine the proper amount of drift control to add:

3 x 2 Oz / 100 Gal = 6 fl oz



Drive the Proper Speed!

10 mph Turbo-Drop

GPA = 25

Example 2: Tank mix a 1,000 gallon solution of *Roundup PROMAX®* + *Escort® XP* + *Outrider®* for Johnsongrass control, using your Flex-5 Spray head:

Step 1: Determine the number of acres you can spray:

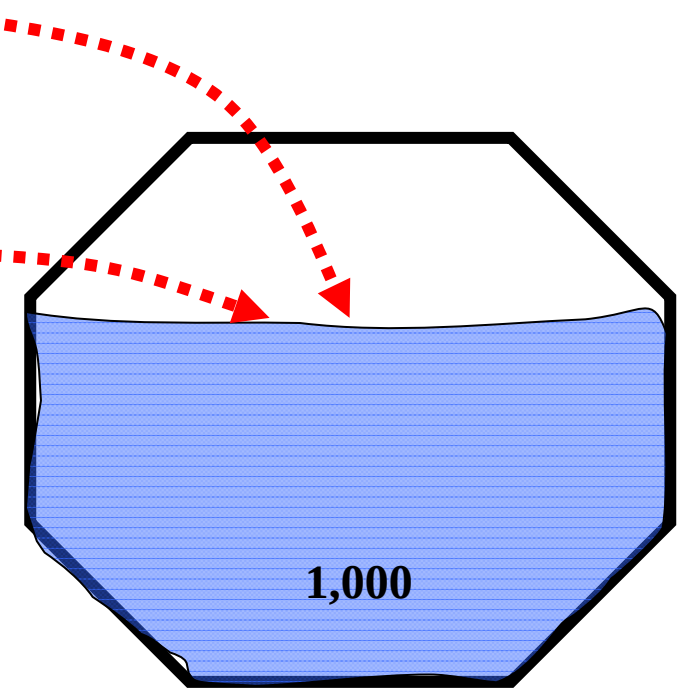
$$\frac{\text{1,000 gal}}{\text{25 GPA}} = \text{40 Ac}$$

Step 2: Determine the proper amount of chemical to add:

40 Ac x 8 Oz / Ac = 10 Qts
40 Ac x 1 Oz / Ac = 40 Oz.
40 Ac x 1.33 Oz/Ac = 53 Oz.

Step 3: Determine the proper amount of drift control to add:

10 x 2 Oz / 100 Gal = 20 fl Oz



Drive the Proper Speed!

(11.36 mph)

Calibration Summary

- **Calibrate your Fixture Booms at least ANNUALLY**
- **Record your Calibration Numbers in your RECORD BOOK**
- **Calibrate the Nozzle Combinations you Normally Use (could be more than one combination)**
- **If you're not sure what your Nozzles are Spraying, CALIBRATE THEM before you spray any chemical**
- **The FLEX - 5 Spray Boom has been Pre-Calibrated To 25 GPA**

TIMING OF HERBICIDE OPERATIONS

General Information

The time of the year that various herbicides are applied is very important. Herbicide application timing affects how well the treatment will control the weed problem for which it is directed without causing damage to desirable vegetation on the right-of-way. The herbicide application for weed control must also be applied at a time of the year so that it does not effect the establishment and propagation of wildflowers.

The following table outlines the recommended time of the year when herbicide operations should occur:

Herbicide Operations	Targeted Plants	Application Months
Edge of Pavement/Guardrails	Bermudagrass	March – September
Broadcast Applications	Johnsongrass and Broadleaf Weeds	June – October
Rip-rap, Medians, Gores and Retaining Walls	All Vegetation	Year Round
Other Noxious Weeds	Field Bindweed, Giant Ragweed, Sunflowers, Georgia Cane, Musk Thistle, African Rue, Broadleaf	June - October
Trees and Brush	Mesquite, Huisache, Retama	June – October
Aquatic Weeds	Cattails	April - October

QUICK REFERENCE TABLE

Target/Type of Control Desired	Herbicide	Application Rate	Optimum Treatment Period	Comments
Guardrails, delineators, mailboxes, signage (removal of tall weeds)	*Roundup PROMAX®* + *Escort® XP* + *Outrider®*	8 ounces + 1 ounce + 1.33 ounces per acre	Apply after wildflowers seed & before July 31st.	Complete control (bare ground) beneath guardrails, under delineators and around sign supports is not recommended. *Vista® XRT* at the rate of 6 ounces per acre can be combined with the three way or two way mixtures for the control of Giant Ragweed without the need of a surfactant.
	Roundup PROMAX® + *Outrider®*	8 ounces + 1.33 ounces per acre	Can be applied until October 15th.	
Edge of Pavement, (Bare Ground edge of pavement application, no more than 6 inches from edge of road surface)	*Roundup PROMAX® with Landmark® XP*	3 quarts per acre + 2-3 ounces per acre	March through September	Add 2 ounces of Landmark® XP with 3 quarts of Roundup PROMAX® to provide short term control of edges and 3 ounces for extended control of vegetation in Edge of Pavement.
Switchgrass	*Roundup PROMAX®*	1.5 % Solution	Apply while actively growing	Spot treatment during growing season.
		25 % Solution		Rotowiper® application.
Johnsongrass control	*Roundup PROMAX®* + *Outrider®*	8 ounces + 1.33 ounces per acre	Early boot to early seedhead	Fixture or Flex-5. For use in Bahiagrass areas.
	Roundup PROMAX® + *Escort® XP* + *Outrider®*	8 ounces + 1 ounce + 1.33 ounces per acre		Fixture or Flex-5 booms. In areas of good wildflowers, do not continue use of Escort® XP in wide patterns (overspray) after July 31st and Outrider® after October 15th.
	Outrider®	1.33 ounces per acre + ½ % Surfactant		Fixture or Flex-5. Where Roundup PROMAX® brownout has been a problem. Add surfactant at 2 quarts per 100 gallons of water.
	Roundup PROMAX®	1.5 parts water, part chemical		Ropewick. May require 1:1 ratio.

QUICK REFERENCE TABLE (contd.)

Target/Type of Control Desired	Herbicide	Application Rate	Optimum Treatment Period	Comments
Guinea Grass	*Roundup PROMAX®*	1.5 % Solution	Apply while actively growing	Spot treatment during growing season.
		10 ounces per acre		Fixture or Flex-5 booms.
Itchgrass	*Roundup PROMAX®*	1.5 % Solution	Apply while actively growing	Spot treatment during growing season.
	Roundup PROMAX® + Landmark XP®	12 ounces plus 2 ounces per acre		Overspray with Roundup PROMAX® at 12 ounces plus Landmark XP at 2 ounces per acre. Flex-5 or Fixture booms.
Wildoats or Jointed Goatgrass	*Roundup PROMAX®*	10 ounces per acre	Late March	Spray before seed mature.
Riprap, Paved Medians, Raised Medians and Retaining Walls (Bare Ground)	*Roundup PROMAX®*	3 quarts per acre	Year Round	Overspray Operations.
		1.5 % Solution		Handgun Operations
Aquatic Vegetation (standing or running water present)	*Approved Aquatic Herbicide (54% Glyphosate)*	8 quarts per 100 gallons of water	When vegetation is actively growing	Handgun operations. Add surfactant at the rate of 2 quarts/100 gallons of water.
Sunflower	*Transline®*	10 fluid ounces per acre	Late Spring / Early Summer	Fixture or Flex-5 boom. Apply before plants mature.
		10 fl ounces per 100 gallons		Handgun operations.
Musk Thistle	*Transline®*	10 fluid ounces per acre.	Early Spring	Fixture or Flex-5 boom.
		10 fl ounces per 100 gallons.		Handgun operations.

QUICK REFERENCE TABLE (contd.)

Target/Type of Control Desired	Herbicide	Application Rate	Optimum Treatment Period	Comments
Giant Ragweed (Bloodweed)	*Vista® XRT*	6 fluid ounces per acre	Late Spring / Early Summer	Fixture or Flex-5 spray boom. Apply before plants mature. Add surfactant at the rate of 2 quarts per 100 gallons of water. *Vista® XRT* can be combined with the three way or two way mixtures without the need of a surfactant.
		6 fl ounces per 100 gallons		Handgun operations. Add surfactant at the rate of 2 quarts/100 gallons of water.
Kochia	*Vista® XRT*	6 fluid ounces per acre	When vegetation is actively growing	Fixture or Flex-5 boom. Add surfactant at the rate of 2 qts. per 100 gallons of water.
Russian Thistle	*Vista® XRT* + *Escort® XP*	6 fluid ounces per acre + 1 ounce per acre		
Mesquite & Huisache	*Transline®*	21 oz/ac + 2 qts. surfactant per 100 gallons of water.	Mid-Summer / Early Fall	Overspray operations with Flex-5 boom.
Mesquite & Huisache, Low Volume Foliar Spray	*Transline®*	*Transline®* - ½% + surfactant – ½% (2 qts. /100 gallons of water).	Mid-Summer / Early Fall	Use low volume X6 tip. 25 gallon Poly Tank with 12 volt electric pump
Field Bindweed	*Escort® XP*	1 ounce per acre	June-September	Add surfactant at the rate of ¼% (1 quart per 100 gallons of water).
Common Sunflower		1 ounce per acre	Spray when 2-3 feet in Height	
Western Bitterweed		1 ounce per acre	March-April	
Turnip Weed		1 ounce per acre	February-March	
Morning Glory Vine		1 ounce per acre	June-September	
African Rue		3 ounce per acre	September	
Other Broadleaf Weeds		1 ounce per acre	May-July 31st	Rate to be added to two-way, three-way or four-way mixture. Overspray use.

QUICK REFERENCE TABLE (contd.)

Target/Type of Control Desired	Herbicide	Application Rate	Optimum Treatment Period	Comments
Chemical Pruning (overhanging trees and brush encroaching on right-of-way or covering roadway signage)	***Milestone® VM Plus***	**6 pints per acre + 2 quarts surfactant per 100 gallons of water**	**When vegetation is actively growing**	**Overspray operations with Flex-5 boom. Used for chemically pruning overhanging trees and brush.**
Chemical Pruning in areas where there are a lot of undergrowth and Hackberry trees	***Milestone® VM Plus + Vista® XRT***	**6 pints per acre + 6 ounces per acre + 2 quarts surfactant per 100 gallons of water**	**When vegetation is actively growing**	**Overspray operations with Flex-5 boom. Used for chemically pruning overhanging trees and brush.**
Brush * (Mesquite, Huisache, etc)	***Pathfinder II®***	**Basal Bark Treatment**	**Year Around (Fall least preferable)**	**Cone Jet #5500, X1 or X2 nozzle required. Spray lower 12"-15" of stem. Complete coverage required. Do not spray to point of runoff.**
***Optional Basal Bark and cut stump applications with *Pathfinder II®* can be used at any time during the year.**				
Kudzu * **	***Transline®***	**21 fluid ounces per acre + 2 quarts surfactant per 100 gallons of water**	**When vegetation is actively growing**	**Handgun operations. Add surfactant at the rate of 2 qts/100 gallons of water**
Georgia Cane or Giant Reed	***Approved Aquatic Herbicide (54% Glyphosate)***	**8 quarts per 100 gallons + 2 quarts surfactant per 100 gallons of water**	**September - October**	**Handgun operations. Add surfactant at the rate of 2 quarts per 100 gallons of water**
*****Please Note: *Transline®* at 21 ounces per acre is the maximum use rate per year. Kudzu is a very aggressive vine and additional treatments will need to be planned and scheduled for future years to gain total eradication of this noxious weed.**				

Herbicide Half-Life and Wait to Spray Times

	Half-Life of Herbicide in Contact with Soil	Half-Life of Herbicide in Water @ 105°F or Above	Annual not to Exceed Rates	Visual Effects of Wilting after Application	Time Required Prior to Rainfall after Application	Formulation
Monsanto *Roundup Pro®* *(Discontinued)*	0 Days	Indefinite, if solution is mixed in clean, pure water. Very short life if water is high in pH or dirty.	10.6 qt./Ac	Annual Plants 2-4 Days and Perennial 7 Days or more	1-2 Hours	Isopropylamine Salt Glyphosate with Surfactant, Water Soluble Liquid
Monsanto *Roundup PROMAX®*	0 Days	Indefinite, if solution is mixed in clean, pure water. Very short life if water is high in pH or dirty.	7 qt./Ac	Annual Plants 2-4 Days and Perennial 7 Days or more	.5 Hours	Potassium Salt Glyphosate with Surfactant, Water Soluble Liquid
Monsanto *Outrider®*	28 Days	16 days if pH is at 7.	2.66 oz./Ac	2-3 Weeks & 4-6 Weeks	1-2 Hours	Sulfosulfuron Dispersible Granules
Approved Aquatic Herbicide, *Aquamaster® or Rodeo®*	0 Days	Indefinite, if solution is mixed in clean, pure water. Very short life if water is high in pH or dirty.	N/A	Annual Plants 2-4 Days and Perennial 7 Days or more	6 Hours	Glyphosate without Surfactant, Water Soluble Liquid
BASF *Habitat®*	35-60 Days	3-15 days. Depends on clarity of the water.	96 oz/ac	2-4 Weeks	1 Hour	Imazapyr, Liquid Concentrate
Dupont *Escort® XP*	20 Days	12-15 days if pH is at 7. More days if pH is higher and less days if pH is lower.	4 oz./Ac	2-4 Weeks & 4-6 Weeks	1-2 Hours	Metsulfuron Methyl, Dispersible Granules
Dupont *Landmark® XP*	40 Days	Tank Temperature = 110-115F pH5 = 80% at 10 hours pH7 = 95% at 4+ days pH9 = 80% at 3 days	9 oz./Ac	2-3 weeks & 4-6 Weeks	1-2 Hours	Sulfometuron Methyl and Chlorsulfuron, Dispersible Granules
Dow AgroSciences *Transline®*	23 Days	30 days at pH range of 5-9 at 77^0F. Would not expect this to be significantly different at 105^0F +	21 oz./Ac	1 Hour	.5 Hours	Clopyralid, Liquid Concentrate

Herbicide Half-Life and Wait to Spray Times (contd.)

	Half-Life of Herbicide in Contact with Soil	Half-Life of Herbicide in Water @ 105°F or Above	Annual not to Exceed Rates	Visual Effects of Wilting after Application	Time Required Prior to Rainfall after Application	Formulation
Dow AgroSciences *Pathfinder II®*	28 Days	Does not mix with water	N/A	2-3 Days or more	.5 Hours	Triclopyr, Ready to use Liquid
Dow AgroSciences *Vista® XRT*	14 Days	185 days @ 68^{o} F. Would not expect this to be significantly different at 105^{0}F +	22 oz/ac	1 Day	1 Hour	Fluroxypyr, Liquid Concentrate
Dow AgroSciences *Milestone® VM Plus*	Aminopyralid 34.5 days, triclopyr 30 days	(When in solution in spray tank) stable to hydrolysis, photodegrades in water in sunlight through UV (spray tanks have UV protection) Half life of herbicide in water in sunlight. Aminopyralid 16 hours, triclopyr 8 hours	9 pt/ac	Varies with the species, can be from 6 to 48 hours, or on Russian knapweed can be as long as 3 months	No recommenda-tion but 2-6 hours might be good	aminopyralid and triclopyr

DHT Numbers for Selected Equipment/Chemicals/Components

(For an up to date DHT listing with photos go to: http://crossroads/org/mnt/VM/main.htm)

Model 85 & 95 Herbicide Truck Part Description	DHT No.
Components & Actuator	
Actuator, Mechanical; Linear, 12V-DC with 8 inch stroke length, Clevis Mount (See "Pin" Quick Release)	116383
Component, (Shop Built) Bumper, Large Truck	159253
Component, (Shop Built) Bumper, Small Truck	159252
Component, (Shop Built) Control Stand F/Cab	156614
Component, (Shop Built) De-Icer, Large and Small Truck (Complete)	158293
Component, (Shop Built) Front End Assembly, Complete, Small Truck	157082
Component, (Shop Built) Front End Assembly, Complete, Large Truck	157083
Component, (Shop Built) Front End Bracket, Small Truck	156740
Component, (Shop Built) Front End Bracket, Large Truck	156741
Component, (Shop Built) Front End, Right & Left	156610
Component, (Shop Built) Front End Manifold Tube	156613
Component, (Shop Built) Manifold, Stainless, Skid Mount	159972
Component, (Shop Built) Mirror Bracket (New right and left bracket)	156612
Mirror, Convex, 12", Round, Acrylic Lens, Steel Back, Rubber Lens Retainer	155489
Pin, Quick Release, 1" Diameter x 2 ½ inches long, Type 303 Stainless Steel (For Actuator)	156285
Pin, Quick Release, ½" Diameter x 3 inches long, Type 303 Stainless Steel (For Actuator)	156286
Electrical & Digital Speed Indicator	
Alarm; Backup; Electric; 12Volt; 97DB(A); F/Automotive Use	5340
Component, (Shop Built) Lighted Control Panel, F/Cab	156611
Digital Speed Indicator; 12V Continuously Hot (.08 AMPS) for information storage.	114730
Lamp; Miniature; GEC 1815; Indicator; 14 Volt; Min. Bay.; T-3 ¼ (For Lighted Control Panel)	4770
Light Pilot; Double Wire Lead; 12 Volt; Indicator (For Lighted Control Panel)	4793
Pulse Driver; Transmission, 12 Volt, Pulse Divider, Electronic (Chevy)	147482
Sensor, Speed, Electronic Area Measuring Instruments (Ford)	155361
Switch; Toggle, Green LED, Lighted, 30A/12V DC (Calterm Part number 40293) (For New Style Lighted Control Panel	162493
Switch, Toggle, Heavy Duty, SPST, on-off, 15 Amp, 125 Volt, Solder (For Lighted Control Panel)	131352
Switch, 6 Position, 2 Pole, Momentary, 20 Amp, 28 Volt (For Lighted Control Panel)	1624

Model 85 Herbicide Truck Part Description (contd.)	DHT No.
Engine, Filter, Drift Injection & Pump Assembly	
16-Mesh Screen Only	134589
50-Mesh Screen Only	36857
Cable Throttle; Veriner Locking Control; 20’	116055
Centrifugal Pump; 1-1/4” NPT inlet; Cast Iron; 1” outlet; 105 gpm; Hypro 9202C	114520
Drift Control Cap PVC, Slip; 3”; Schedule 40;	4987
Drift Control Tube; Clear Plastic; 3”, Schedule 40, W/UL rating, order per foot	114746
Drift Control Tube Assembly, with all as shown with filter assembly	156922
Engine Diesel; 9 HP; 4 Cycle; Air Cooled; Single Cylinder	153422
Engine Gasoline; 8 HP; 4 Cycle; Air Cooled; One or more cylinders with horizontal shaft	114457
Line Strainer; 1 1/2” FPT; Aluminum; 5 3/8” x 8”; includes 16 mesh screen	132919
Line Strainer; 3/4” NPT; Female; Aluminum Head; Nylon Bowl; 150 psi; includes 50 mesh screen	8085
Motor Mount; Rubber; 2” DIA x 1-1/8” STUD; 3/8”-16 THD	150775
Petcock; Brass; 1/8” MPT x 5/32” PORT; 80 lb.; Tee Handle	118754
Pulley; V-Type; 3” DIA; ½”; 5/8” Bore; W/Hub & Bearing (Used for both pump and Diesel Engine Shafts) (New Style)	114406
Pulley; V-Type; Fixed Bore Cone Groove; OD 5.93 Inches (Used in problem situations)	114403
Relay, Automotive, 12 Volt DC, 45 Amp, 4 Circuit, Continuous Duty. (Engine Starter Relay)	118550
V-Belt; Automotive; Gates 9375 or DRA 17-377 (Engine to pump v-belt)	27472
V-Belt; Automotive; Gates 9403 or Equal (Larger Engine to Pump V-Belt used when using Pulley # 114403)	160951
Gauges, Solenoids, Pressure Regulator Valves	
Bushing, Brass, Reducing, ¾ inch MPT x ¼ inch FPT (Nipple pipe to solenoid bushing)	115263
Component, (Shop Built) Front End Manifold Tube	156613
Coupling, Stainless Steel, ¼ inch internal pipe size (IPS), Type 304. (Nipple Pipe to Pressure Gauge)	118385
Electric solenoid 12 VDC; 3/4” x 3/4” x 1/2” IPS;	8351
Ell, Nylon, ¾ inch MPT x ¾ inch Hose x 90 Degrees	118748
Nipple, Pipe, Brass, ¼ inch x 21 inches, MPT	132939
Pressure Gauge; Main; 0-160 psi; Liquid Filled; 1/4 BTM Connection	104706
Pressure Gauge; System; 0-60 psi; Liquid Filled; 1/4 BTM Connection	6436
Pressure Regulator Valve; 3/4” FPT; 25-75 PSI; Watts U5B (New Style)	116804
Pressure Regulator Valve; 3/4” FPT; 25-75 PSI; (Old Style, plastic bell)	157101
Herbicides, Additives, Surfactants, Wind & Safety	
Drift Control; Control WM, order by quarts	

Model 85 Herbicide Truck Part Description (contd.)	DHT No.
Eyewash Kit; Emergency; Sterile; 8 oz. Premixed	151194
Anti-Foam/Defoamer – Additive; Garrco Produts, order by quarts	165730
Herbicide; Approved Aquatic Herbicide (*Aquamaster*® or *Rodeo*®); (1)-2 ½ gallon containers per unit	43138
Herbicide; *Escort*® *XP*; (6)-4 lb. containers per unit	166223
Herbicide; *Landmark*® *XP*; (1)-4 lb. containers per unit	164546
Herbicide; *Outrider*®; (1)-20 oz containers per unit	157652
Herbicide; *Pathfinder II*®; (1)-2 ½ gal containers per unit	151135
Herbicide; *Transline*®; (1)-2 ½ gal containers per unit	145763
Herbicide; *Round PROMAX*® (2)-1.67 gal containers per unit	
Herbicide; *Vista*® XRT; (2)-2 ½ gal containers per unit	166018
Insecticide; Award®; (1)- 3 lb. container per unit	137728
Insecticide; Milestone® VM Plus; (1)-2 ½ gal containers per unit	166035
Insecticide; Fire Ant Aerosol	160427
Insecticide; Rod for Fire Ant Aerosol	160428
Insecticide; Altosid XR®; Mosquito Larvicide; 220 Briquets per case	161518
Surfactant; Approved, Non-ionic; spreader/activator, comes packed 1 gallon jug per unit	160055
Spill Kit; Herbicide, for sprayer truck, includes absorbent pads/coils, goggles, gloves.	148503
Thermometer; minimum/maximum, -30 to 120 degrees Fahrenheit with 2 degree increments	2229
Windmeter; Portable, Hand Held, measure wind speed from 2-66 mph. All Supply Centers.	119718
Nozzles & Fittings on Boom	
Adapter; brass; 3/8” FPT x 1/4” FPT	55054
Coupling, Reducing Bell, ½ inch x ¼ inch, FNPT, Stainless Steel	118384
Coupling, Stainless Steel, ¼ inch internal pipe size (IPS), Type 304.	118385
Diaphragm Check Valve; Nylon; 30# spring pressure;	119628
Double swivel brass nozzle assembly; male 1/4”; includes Spray Systems stainless steel OC08 Tips	6867
Double swivel brass nozzle assembly; 1/4”; without tips	155586
Nipple; Pipe, Brass, ¼” X Close, MPT	6854
Nozzle Cap; brass; 3/8” NPT	14366
Nozzle; Spray, Turbo Drop Style, Nozzle Only with Ceramic Inserted Air Injector, Attaches to Body 162529 & 162530	162528
Nozzle; Spray, Air Injection Body for 162528	162529
Nozzle; Single Swivel Quick Tee-Jet, ¼” FPT, Attaches to Air Injection Body-162529	162530

Model 85 Herbicide Truck Part Description (contd.)	DHT No.
Single swivel brass nozzle assembly; male 1/4”; includes Spray Systems stainless steel 2508 Tip	6866
Single swivel brass nozzle assembly; male 1/4”; includes Spray Systems stainless steel 6508 Tip	6862
Single swivel brass nozzle assembly; 1/4”; without tips	127752
Spring, Extension, industrial, 1 inch diameter by 5 ½ inches long	7848
Stainless Steel Nozzle Tip; Spray Systems 2508	48788
Stainless Steel Nozzle Tip; Spray Systems 6508	51245
Stainless Steel Nozzle Tip; Spray Systems 8008	8194
Stainless Steel Nozzle Tip; Spray Systems OC08	119592
Plastic Quick-off Fittings	
Adapter, Nylon, ¼ inch FPT x Male quick disconnect	116598
Adapter, Nylon, ½ inch FPT x Male quick disconnect	116597
Cap, Dust, ¾ inch Cam Lever Quick Disconnect	118422
Cap, Dust 1 inch Cam Lever Coupling, Fiberglass Reinforced	159224
Coupling; Hose; Nylon; ¾ inch; Hose Shank x Female Cam Lever, Quick Disconnect	114586
Coupling; Cam-Lock Poly; 1 inch Female x 1 inch Hose Shank	158953
Coupling; Cam-Lock Poly; 1 inch Male x 1 inch Hose Shank	158955
Coupling; Cam-Lock Poly; 1 inch Male x 1 inch MPT	158956
Coupling; Cam-Lock Poly; 1 ½ inch Female x 1 ½ inch Hose Shank	158954
Coupling; Cam-Lock Poly; 1 ½ inch Male x 1 ½ inch MPT	158957
Miscellaneous Truck Parts	
Agitator, plastic; FPT, heavy duty, on older models	58854
Agitator, plastic; MPT, heavy duty, on newer models	153901
Bibb, Hose ½ inch Rough Brass, Tee Handle for 30 gallon skid mount clean water tank	33869
Bushing, Brass, Reducing, ¾ inch MPT x ¼ inch FPT	115263
Bushing; Brass, ½” FPT X ¾” MHT (Male Hose Thread), HEX	154967
Bushing; Brass, Reducing, ¾” MPT X ¼” FPT	115263
Bushing, Brass, Reducing, 1 inch MPT x ¼ inch FPT	155573
Bushing, Stainless Steel, Reducing, 1 inch MPT x 3/8 inch FPT	118396
Bushing, Stainless Steel, Reducing, 1 ½ inch MPT x 3/8 inch FPT	132934
Bushing, Stainless Steel, Reducing, 1 ½ inch FPT x 1 ¼ inch FPT	132933
Coupling, Stainless Steel, ¼ inch internal pipe size (IPS), Type 304	118385
Coupling, Stainless Steel, ½ inch internal pipe size (IPS), Type 304	115522

Model 85 Herbicide Truck Part Description (contd.)	DHT No.
Coupling, Stainless Steel, ¾ inch internal pipe size (IPS), Type 304	118387
Coupling, Stainless Steel, 1 inch internal pipe size (IPS), Type 304	115524
Coupling, Stainless Steel, 1 ½ inch internal pipe size (IPS), Type 304	132922
ELL; Brass, 1" X 45 Degrees, FPT	160794
Ell, Stainless Steel, 1 inch x 45 Degrees	148186
Ell, Nylon, ½ inch MPT x ½ inch Hose x 90 Degrees	119888
Ell, Nylon, ½ inch MPT x ¾ inch Hose x 90 Degrees	155891
Ell, Nylon, ¾ inch MPT x ½ inch Hose x 90 Degrees	118747
Ell, Nylon, 1 inch MPT x 1 inch Hose x 90 Degrees	149851
Ell, Stainless Steel, Street, ½ inch, 90 Degrees	145129
Ell, Stainless Steel, Street, 1 ½", 90 Degrees	122334
Flex-5 Assembly	156615
Handgun; pistol-grip; Green Guard	154690
Hose, Low Pressure, ½ inch ID x 0.75 inch OD, 300 lb. Working Pressure (Handgun Hose)	2621
Clamp, Hose, S.S., Size 8 (for ½ inch ID Hose)	12277
Hose, Low Pressure, ¾ inch ID x 1.04 inch OD, 300 lb. Working Pressure (Flex 5 and Agitator Hose)	32759
Clamp, Hose, S.S., Size 12 (for ¾ inch ID Hose)	12276
Hose, Low Pressure, 1 inch ID x 1.45 inch OD, 212 lb. Working Pressure (Pump to Manifold to Front of Truck)	46678
Clamp, Hose, S.S., Size 20 (for 1 inch ID Hose)	36546
Hose, Low Pressure, 1 ½ inch ID x 2.01 inch OD, 162 lb. Working Pressure (Pump to Manifold and Bypass Hose)	60561
Clamp, Hose, S.S., Size 32 (for 1 ½ inch ID Hose)	9760
Nipple, Pipe Brass, 3/8 inch x Close MPT	75476
Nipple, Pipe, Brass, ½ inch x Close, MPT	42581
Nipple, Pipe, Brass, ¾ inch x Close, MPT	42590
Nipple, Pipe, Brass, 1 ½ inch x Close, MPT	115528
Nipple, Hose Nylon, ½ inch MPT x ½ inch Hose	124295
Nipple, Hose Nylon, ¾ inch MPT x ¾ inch Hose	116593
Nipple, Hose Nylon, ¾ inch MPT x 1 inch Hose	133279
Nipple, Hose Nylon, 1 inch MPT x 1 inch Hose	118753
Nipple, Pipe, Stainless Steel, 1 ¼ inch x Close, MPT	118428
Nipple, Pipe, Stainless Steel, 1 ½ inch x Close, MPT	132921
Nipple, Pipe, Stainless Steel, 1 ½ inch x 1 ½ inch Hose	154776
Plug, Pipe, Square Head, Brass, ¾ inch MPT	132946

Model 85 Herbicide Truck Part Description (contd.)	DHT No.
Reel Hose; W/50' x 1/2" Hose; 400 psi Working Pressure	149527
Reel Hose; Manual Crank, W/200 foot x ½ inch ID x 7/8 inch OD Hose (New Style)	158661
Tank Polyethylene; 15 Gal; Herbicide Fill Tank	114741
Tank Polyethylene; 30 Gal; Horizontal; Skid Mount	154542
Tank Polyethylene; 525 Gal; Horizontal Leg; Two Leg	153743
Tank Polyethylene; 1250 Gal; Horizontal Leg; Four Leg	153519
Tank Lid; 10-inch, Poly, Threaded for 15 Gallon Conical.	160032
Tee, Nylon, ¾ inch x ¾ inch x ¾ inch Hose	118750
Tee, Pipe, Brass, 1 inch FPT	105979
Tee, Pipe, Brass, 1 ½ inch FPT	132936
Valve; Ball; 3/8 inch Bronze, 150 Lb.; SWP; 400 Lb.; WOG; Plastic (Drift Control)	8340
Valve; Ball; ½ inch; Bronze; 2-PC Construction; Brass Ball (Handgun Valve)	22526
Valve; Ball; ¾ inch; Brass Ball; 2-PC Construction (Agitator)	8844
Valve; Ball; 1 ½ inch; Bronze; Teflon Seat; 3-PC Construction	8846
Nozzles for Flex-5 Heads (Serviced by Veg Staff only)	
Nozzle, Spray, S.S., 0 Degree Stream Nozzle	54831
Nozzle, Spray, S.S., 15 Degree Spray Angle	54860
Nozzle, Spray, S.S., 25 Degree Spray Angle	119177
Nozzle, Spray, S.S., 65 Degree Spray Angle	114743
Vane, Guide, Fits ¼ inch Spray Nozzle	114725
Parts for De-icer Units	
Adapter, Brass, 3/8 inch FPT x ¼ inch FPT	55054
Adapter; PVC, Male, 1 inch MPT x Slip	41075
Adapter; PVC, Female, 1 ½ inch Slip x 1 ½ inch FPT	155577
Bushing; Reducing, Brass, 1 inch MPT x ¼ inch FPT	155573
Bushing; Reducing, PVC, 1 ½ inch Slip x 1 inch FPT	155576
Cable; Electrical, Battery End, 12 Feet	155582
Cable; Electrical, Harness Extension	155581
Cable; Electrical, Valve End, 15 Feet	155583
Cap; PVC, Slip 1 inch	37502
Component; Herbicide, (Shop Built) De-icer, (Small) (Complete Unit)	158587
Component; Herbicide, (Shop Built) De-icer, (Large) (Complete Unit)	158293
Control Panel; Sprayer, For De-icer Bloom	155578

Model 85 Herbicide Truck Part Description (contd.)	DHT No.
Coupling Assembly; Tubing, 1/8 inch MPT, Consists of Three Parts	155640
De-icer Kit, Consists of 8 Poly Electrical Connectors	155584
Elbow; PVC, 1 inch 90 Degrees, Slip x Slip	26172
Hose, Low Pressure, 1 inch Green Stripe, 50 Feet in Length	25620
Clamp, Hose, S.S., Size 20 (for 1 inch ID Hose)	36546
Nipple, Hose Nylon, 1 inch MPT x 1 inch Hose	118753
Nipple, Pipe, Stainless Steel, 1 ½ inch x 1 ½ inch Hose	154776
Nipple, Pipe, Stainless Steel, 1 inch x Close, MPT	148185
Nozzle; Spray, Herbicide, ¾ inch MPT, RA 60-140, 100 PSI	155587
Swivel; Double, Brass, ¼ inch MPT Inlet x ¼ inch MPT Outlet	155586
Tee, Pipe, Brass, 1 inch FPT	105979
Tee; PVC, 1 inch x 1 inch x ¾ inch, Slip x Slip x FPT	26247
Tee; PVC, 1 inch x 1 inch x 1 inch, Slip x Slip x FPT	155575
Tip; Spray, Stainless Steel, ¼ inch, Solid Stream (0030G)	156104
Valve; Ball, 1 inch, Bronze, Teflon Seat	1424
Valve; Control, Directional	155579
Valve; Control, Pressure	155580
Vane; Guide, Fits ¼ inch Spray Nozzles	114725
Miscellaneous	
Spill Kit; Emergency	148503
Switch Ignition; Starter Switch; 12Volt Single Throw; UNV UM23	115468

Useful Conversion Factors

English To Metric

Multiply	By	To Get
Acres	0.404	Hectares (ha)
Acres	4046.9	Square Meters (m^2)
Cubic Yards	0.765	Cubic Meters (m^3)
Cubic Feet	28.317	Liters (L)
Cups	0.237	Liters (L)
Feet	0.305	Meters (m)
Feet per Second	1.097	Kilometers per Hour (km/h)
Gallons	3.785	Liters (L)
Gallons per Square Foot	41.132	Liters per Square Meter (L/m^2)
Gallons per Square Yard	4.527	Liters per Square Meter (L/m^2)
Gallons per Acre	9.369	Liters per Hectare (L/ha)
Inches	2.54	Centimeters (cm)
Inches	25.4	Millimeters (mm)
Miles	1.609	Kilometers (km)
Miles per Hour	1.609	Kilometers per Hour (km/h)
Ounces (mass)	28.35	Grams (g)
Ounces (fluid)	29.573	Milliliters (mL)
Ounces (mass) / Sq. Ft.	305.2	Grams per Square Meter (g/m^2)
Ounces (fluid) / Sq. Ft.	41.132	Liters per Square Meter (L/m^2)
Ounces (mass) / Acre	70.0	Grams per Hectare (g/ha)
Ounces (fluid) / Acre	73.0	Milliliters per Hectare (mL/ha)
Pints	0.473	Liters (L)
Pounds (mass)	0.454	Kilograms (kg)
Pounds (mass) / Gallon	0.12	Kilograms per Liter (kg/L)
Pounds (mass) / Cu. Ft.	16.018	Kilograms per Cu. Meter (kg/M^2)
Pounds (mass) / Acre	1.121	Kilograms per Hectare (kg/ha)

Pounds (mass) / Sq. Ft.	**4.883**	**Kilograms per Sq. Meter (kg/M^2)**
Pounds (force) / Sq. Inch	**6.89**	**Kilopascals (kPa)**
Pounds (force) / Sq. Ft.	**47.88**	**Pascals (Pa)**
Quarts per Acre	**2.33**	**Liters per Hectare (L/ha)**
Quarts	**0.946**	**Liters (L)**
Square Inches	**6.452**	**Square Centimeters (cm^2)**
Square Feet	**0.093**	**Square Meters (m^2)**
Square Yards	**0.836**	**Square Meters (m^2)**
Ton (2,000 Lbs.)	**0.907**	**Megagrams (Mg)**

Useful Conversion Factors (contd.)

Metric to English

Multiply	By	To Get
Hectares (ha)	**2.475**	**Acres**
Square Meters (m^2)	**0.000247**	**Acres**
Cubic Meters (m^3)	**1.307**	**Cubic Yards**
Liters (L)	**0.035**	**Cubic Feet**
Liters (L)	**4.219**	**Cups**
Meters (m)	**3.279**	**Feet**
Kilometers per Hour (km/h)	**0.912**	**Feet per Second**
Liters (L)	**0.264**	**Gallons**
Liters per Square Meter (L/m^2)	**0.024**	**Gallons per Square Foot**
Liters per Square Meter (L/m^2)	**0.221**	**Gallons per Square Yard**
Liters per Hectare (L/ha)	**0.107**	**Gallons per Acre**
Centimeters (cm)	**0.394**	**Inches**
Millimeters (mm)	**0.039**	**Inches**

Kilometers (km)	**0.622**	**Miles**
Kilometers per Hour (km/h)	**0.622**	**Miles per Hour**
Grams (g)	**0.035**	**Ounces (mass)**
Milliliters (mL)	**0.034**	**Ounces (fluid)**
Grams per Square Meter (g/m^2)	**0.003**	**Ounces (mass) / Sq. Ft.**
Liters per Square Meter (L/m^2)	**0.024**	**Ounces (fluid) / Sq. Ft.**
Grams per Hectare (g/ha)	**0.014**	**Ounces (mass) / Acre**
Milliliters per Hectare (mL/ha)	**0.014**	**Ounces (fluid) / Acre**
Liters (L)	**2.114**	**Pints**
Kilograms (kg)	**2.203**	**Pounds (mass)**
Kilograms per Liter (kg/L)	**8.333**	**Pounds (mass) / Gallon**
Kilograms per Cu. Meter (kg/M^2)	**0.062**	**Pounds (mass) / Cu. Ft.**
Kilograms per Hectare (kg/ha)	**0.892**	**Pounds (mass) / Acre**
Kilograms per Sq. Meter (kg/M^2)	**0.205**	**Pounds (mass) / Sq. Ft.**
Kilopascals (kPa)	**0.145**	**Pounds (force) / Sq. Inch**
Pascals (Pa)	**0.021**	**Pounds (force) / Sq. Ft.**
Liters per Hectare (L/ha)	**0.429**	**Quarts per Acre**
Liters (L)	**1.057**	**Quarts**
Square Centimeters (cm^2)	**0.155**	**Square Inches**
Square Meters (m^2)	**10.753**	**Square Feet**
Square Meters (m^2)	**1.196**	**Square Yards**
Megagrams (Mg)	**1.103**	**Ton (2,000 Lbs.)**

SECTION 17

17.0 RECORD KEEPING

Accurate records are vital during herbicide mixing and application activities. These records permit the monitoring of the purchase and use of herbicides.

Texas Department of Agriculture (TDA) law requires that records be maintained for a **minimum period of 2 years from the date of application.**

IT IS VERY IMPORTANT AT THE START OF EVERY SPRAYING SEASON TO GET A NEW RECORD BOOK AND START THE YEAR OFF RIGHT.

Records also help determine the effectiveness and durability of a herbicide treatment and will help to determine when an area should be retreated. Specify any unusual conditions, which may exist at the time of application, and maintain daily spray records.

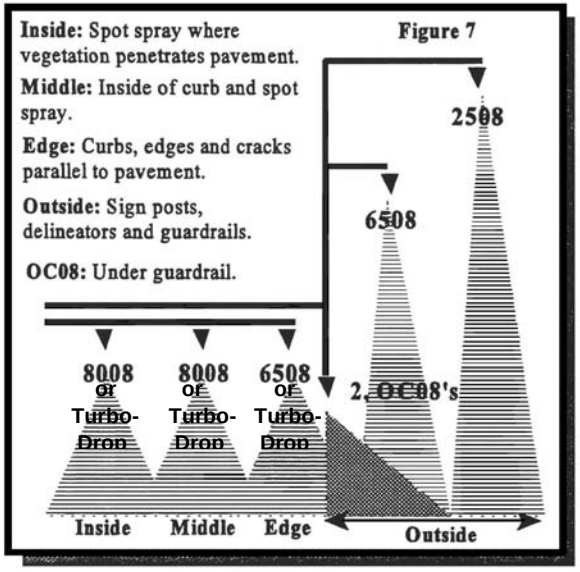
Your district Vegetation Manager or the Vegetation Management Staff of the Maintenance Division can supply you with additional record books.

Examples of the record book is as follows:

HERBICIDE RECORDS

(Revised 11/17/10)
State Law Requires Records be Kept for a Period of Two Years From the Date of the Pesticide Application

Equipment Number:	
Starting Date:	
Ending Date:	
Speed Circumference Number:	



CALIBRATION HISTORY
(Fixture Booms Should Be Calibrated Annually)
(Flex-5 Booms are Pre-Calibrated to 25 Gallons per Acre)

Date	Nozzles Calibrated	Calibrated Rate (GPA)

Name of Applicator: Joe Snuffy

Applicator TDA License Number: 123456

Name of Licensee if Other than Applicator: _____

Mixing Records

(Revised 11/4/10)

A Date	B Herbicide (H) and Additive (A) Mixed	C E.P.A. Registration Number	D Volume Left From Previous Day (Gallons)	E Water Added to Tank (Gallons)	F Calibrated Rate (GPA)	G New Sprayable Acres (E ÷ F)	H Herbicide Application Rate	I Quantity Received from Supply	J New Herbicide Added to Tank (G x H)	K Non-Stock Material (Leftover)
6/16/10	H: Roundup PROMAX	524-579	0	1,300	25	52	8 Oz/Ac	5 Gal. (20 Qt)	3.25 Gal	1.75 Gal
	H: Escort XP	352-439					1 Oz/Ac	(4)-16 =64 Oz.	52 Oz.	12 Oz.
	H: Outrider	524-500					1.33 Oz/Ac	200 Oz.	69.2 Oz.	130.8 Oz.
	H: Vista XRT	62719-586					6 Oz/Ac	2.5 Gallon	312 Oz.	8 Oz.
	S:									
	A: Control						2 Oz/100 Gal.	32 Oz.	26 Oz.	6 Oz.
6/17/10	H: Roundup PROMAX	524-579	725	500	25	20	8 Oz/Ac	1.75 Gal	1.25 Gal	.5 Gal
	H: Escort XP	352-439					1 Oz/Ac	(1)-16 + 12 Oz.	20 Oz.	8 Oz.
	H: Outrider	524-500					1.33 Oz/Ac	130.8 Oz.	26.6 Oz.	104.2 Oz.
	H: Vista XRT	62719-586					6 Oz/Ac	2.5 Gal + 8 Oz.	120 Oz.	208 Oz.
	S:									
	A: Control						2 Oz/100 Gal.	32 Oz.	10 Oz.	22 Oz.
6/18/10	H: Roundup PROMAX	524-579	0	500	34	14.7	3 Qts/Ac	15 Gal. (60 Qt)	44.1 Qt	15.9 Qt
	H: Landmark XP	352-645					3 Oz/Ac	6 Lb (96 Oz)	44.1 Oz.	51.9 Oz.
	H:									
	H:									
	S:									
	A: Control						2 Oz/100 Gal.	32 Oz.	10 Oz.	22 Oz.
6/19/10	H: Aquatic Herbicide	524-343	0	200	100	2	8 Qt/100 Gal.	5 Gal. (20 Qt)	4 Gal.(16Qt)	1 Gal.
	H:									
	H:									
	H:									
	S: Surfactant						2 Qt/100 Gal.	1 Gal. (4 Qt)	1 Gal. (4 Qt)	0
	A: Control						2 Oz/100 Gal.	32 Oz.	4 Oz.	28 Oz.

Mixing Notes:

Name of Applicator: Joe Snuffy

Applicator TDA License Number: 123456

Name of Licensee if Other than Applicator: _____

Application Records

(Revised 11/4/10)

L Date	M Highway Number	N Location and Time		O Target Plant Species	P Weather Data			Q Total Volume Sprayed (Gallons)	R Calibrated Rate (GPA)	S Total Acres Sprayed (Q ÷ R)	T Herbicide Application Rate	U Total Herbicide Sprayed (S x T)
		Start	End		Wind Direct	Wind Speed	Temp (ºF)					
6/16/10	IH 100	Rt 66 10:30 am	MP 510 2:15 pm	Johnsongrass	S	3-5	90	575	25	23	8 Oz/Ac	1.5 Gal
											1 Oz/Ac	23 Oz.
											1.33 Oz/Ac	30.6 Oz.
											6 Oz/Ac	138 Oz.
6/17/10	IH 100	MP 510 8:30 am	RM 99 3:15 pm	Johnsongrass	S	4	83	1225	25	49	8 Oz/Ac	3 Gal
											1 Oz/Ac	49 Oz.
											1.33 Oz/Ac	65.2 Oz.
											6 Oz/AC	294 Oz.
6/18/10	US 66	MP 103 9:15 am	MP 115 11:30 am	Bermudagrass (Complete Control)	SE	5-7	85	500	34	14.7	3 Qt/Ac	44.1 Qts
											3 Oz/Ac	44.1 Oz.
6/19/10	US 90	Brushy Ck 9:00 am	Brushy Ck 9:30 am	Willows & Cattails	S	7-9	85	50	100	.5	8 Qt./100 Gal	4 Qts.
											2 Qt./100 Gal	(1 Qt.)
6/19/10	SH 6	Navasota Rv 10:00 am	Navasota Rv 11:30 am	Willows & Cattails	S	8-10	90	150	100	1.5	8 Qt./100 Gal	12 Qts
											2 Qt./100 Gal	(3 Qts.)

Application Notes:

6/16/10 At 2:15 pm, wind began gusting. Elected to stop spraying for the day.

6/17/10 Noticed what appeared to be herbicide application under TP&E transmission lines, performed by aerial applications which had drifted onto the right-of-way near MP 513. Fruit trees in nearby private property appeared to be affected as the foli[illegible] w[illegible]dwish and about ½ of the leaves had fallen off.

6/18/10 Sprayed the east side of US 66 in Big Sky County.

Name of Applicator: Joe Snuffy

Applicator TDA License Number: 123456

Name of Licensee if Other than Applicator: _____

Mixing Records

(Revised 11/4/10)

A Date	B Herbicide (H) and Additive (A) Mixed	C E.P.A. Registration Number	D Volume Left From Previous Day (Gallons)	E Water Added to Tank (Gallons)	F Calibrated Rate (GPA)	G New Sprayable Acres (E ÷ F)	H Herbicide Application Rate	I Quantity Received from Supply	J New Herbicide Added to Tank (G x H)	K Non-Stock Material (Leftover)
6/20/10	H: Escort XP	352-439	0	1000	25	40	1 Oz/Ac	3 lb	40 Oz (2.5 lb)	8 Oz
	H:									
	H:									
	H:									
	S: Surfactant						1 Qt./100 Gal	3 Gals	2.5 Gals	.5 Gals
	A: Control						2 Oz/100 Gal	32 Oz	20 Oz	12 Oz
6/23/10	H: Pathfinder II	62719-176	Ready To Use	None used, (RTU)	1	1	2.5 Gal/Ac	2.5 Gals	2.5 Gals	0
	H:									
	H:									
	H:									
	S:									
	A:									
6/24/10	H: Milestone VM Plus	62719-572	0	500	25	20	6 Pt/Ac	15 Gals	120 Pt = 15 Gal	0
	H: Vista XRT	62719-586					6 Oz/Ac	2.5 Gals	120 Oz	200 Oz
	H:									
	H:									
	S: Surfactant						2 Qt/100 Gal	3 Gal	10 Qt	2 Qt
	A: Control						2 Oz/100 Gal	12 Oz	10 Oz	2 Oz

Mixing Notes:

6/20/10 Drift control was added at the rate of 2 fluid ounces per 100 gallons of water.
6/23/10 Pathfinder II is a Ready-To-Use product and the application was made with a 3 gallon pump-up sprayer.
6/24/10 Drift control was added at the rate of 2 fluid ounces per 100 gallons of water.

Texas Department of Transportation

Name of Applicator: Joe Snuffy

Applicator TDA License Number: 123456

Name of Licensee if Other than Applicator: _____

Application Records

(Revised 11/4/10)

L Date	M Highway Number	N Location and Time		O Target Plant Species	P Weather Data			Q Total Volume Sprayed (Gallons)	R Calibrated Rate (GPA)	S Total Acres Sprayed (Q ÷ R)	T Herbicide Application Rate	U Total Herbicide Sprayed (S x T)
		Start	End		Wind Direct	Wind Speed	Temp (ºF)					
6/20/10	IH 20	MP 150 9:00 am	MP 175 3:00 pm	Western Bitterweed	N	3-7	88	1000	25	40	1 Oz/Ac 1 Qt/100 Gals	40 Oz 2.5 Gals
6/23/10	SH 83	MP 56 9:30 am	MP 67 2:30 pm	Mesquite	S	4	85	2.5 Gals	2.5	1	2.5 Gal/Ac 	2.5 Gals
6/24/10	FM 555	MP 66 8:30 am	MP 134 4:00 pm	Liveoak, Hackberry (Chemical Pruning)	W	5	83	500	25	20	6 Pt/Ac 6 Oz 2 Qt/100 Gal	15 Gal 120 Oz 10 Qt

Application Notes:

6/20/10: Western Bitterweed was heavy in patches along the Interstate on flat areas lacing natural vegetation.
6/23/10: Mesquite treated was from resprouts from prior treatments and areas treated measured about one acre.
6/24/10: Trees being side trimmed along with hackberries and undergrowth were chemically pruned on the right-of-way using the herbicides Milestone VM Plus and Vista XRT.

Name of Applicator: _____

Applicator TDA License Number: _____

Name of Licensee if Other than Applicator: _____

Mixing Records

(Revised 11/4/10)

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	H:									
	H:									
	H:									
	H:									
	S:									
	A:									
	H:									
	H:									
	H:									
	H:									
	S:									
	A:									
	H:									
	H:									
	H:									
	H:									
	S:									
	A:									

Mixing Notes:

Texas Department of Transportation

Name of Applicator: _____

Applicator TDA License Number: _____

Name of Licensee if Other than Applicator: _____

Application Records

(Revised 11/4/10)

L Date	M Highway Number	N Location and Time		O Target Plant Species	P Weather Data			Q Total Volume Sprayed (Gallons)	R Calibrated Rate (GPA)	S Total Acres Sprayed (Q ÷ R)	T Herbicide Application Rate	U Total Herbicide Sprayed (S x T)
		Start	End		Wind Direct	Wind Speed	Temp (ºF)					

Application Notes:

Remember!

- Maintain Accurate Records for 2 Years from date of Application
- Do your Records As You Go (Don't Wait)
- Maintain Records on ALL Pesticide Applications including:
  - Stockpiles
  - Rest Areas
  - Signal Boxes
  - Maintenance Office

Records can be Your BEST FRIEND!